MANAGEMENT AND ADMINISTRATION

FOR OFFICERS EXECUTIVES AND DIRECTORS OF INDUSTRY

MEN MATERIALS MACHINES

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The Organization of Modern Industry

I. Beginning of the Change from Handicraft to Production

By DEXTER S. KIMBALL

Dean, College of Engineering, Cornell University

THE mind of man, in his long and toilsome journey from savagery to civilization, has been occupied constantly with two great fields of thought. The first concerns the satisfaction of his animal wants, and the subjugation of an unfriendly environment to this end. This endeavor is basic, for man is primarily an animal with all the instincts and appetites of the animal world. But in all times and in all places, even when his animal wants have been barely cared for, he has instinctively turned his mind to the field of speculative philosophy, and has pondered deeply the time-old problem of whence he came, why he is here, and whither he goes when he leaves these mundane activities.

And as man has weighed the relative values of these spiritual speculations against his animal desires he has in all times and in all places evolved therefrom what we are pleased to call *ideals*. These ideals are all powerful since they control and dictate the form of industrial and political organization, and no industrial system can be understood unless a clear conception can be had of the ideals upon which it is based. It should be carefully noted that these ideals are far from *absolute* but are *relative*, only, changing from time to time and from place to place with man's varying conditions and surroundings. Just as *morals* are based upon *custom* so industrial values and industrial relations are based upon the national conception of industry at any time and place. History is filled with illustrations that verify the truth of these statements. In the old civilizations that preceded the present we see war, religion, art, or some other activity forming the central ideal around which all other functions of the state were grouped; and the importance of industry and of the industrial worker were judged solely with reference to their relation to the central ideal. We are prone to think of the ancient Greeks as a great free people holding the highest ideals of liberty and equality. Yet a closer inspection makes it clear that the basis of this great civilization was slavery of an abject kind. Rome, the great law-giver, in whose forums were delivered impassioned speeches in defence of liberty that still remain masterpieces of their kind, was even more frank in recognizing that slavery was essential to the life of the state. Liberty and democracy were for certain

Dexter S. Kimball

kinds of people, but not for all people. This could not be otherwise and maintain the kind of civilization that was desired while Rome was surrounded by barbarous peoples, and while her very existence was based upon tribute from these subject nations. In other words, their ideals were the *ideals of necessity.*

Efforts Toward Universal Well-Being

While it is true that we, in these later days, have made considerable progress away from these ancient ideals it should be remembered that we inherited our present civilization largely from Greece and Rome, and each and everyone of us live today under the shadow of the political institutions that were conceived and developed by these great nations. We talk and write as did the Greeks and Romans of liberty, equality, and brotherly love, but our ideals have remained, to no small degree, the ideals of necessity. Even the influence of the Christian religion, and its influence has been great, has not been able to eradicate entirely some of these old ideals. Nevertheless, if I read American democracy aright, we, in this country, are committed to an effort to attain *universal well-being* and there are some phases of modern industrial life that hold out a hope that this most ancient of all desires and ideals may yet be achieved. The idea that industry should be a means of conferring universal well-being on all men; that all men should be well cared for physically, mentally, and morally, and that industry should not be conducted solely for individual, state, or corporate profit, belongs to modern times and modern ideals. And these conceptions have placed a new evaluation upon industry since it has become clear that physical, mental, and moral well-being are dependent, primarily, upon the industrial background.

The Sources of Wealth

The total amount of wealth or worldly goods that any people can produce depends primarily upon the natural resources at their command and upon the tools of production, mental and manual, which they possess for developing and utilizing these resources. Thus we have many examples of savage nations living in countries rich in agricultural and mineral resources that rise only to the industrial and social level permitted by their elementary tools of production. We have other illustrations of nations that live in territory that offers very meager natural resources, which, by reason of the high development of their tools of production, occupy a foremost place among civilized nations. The true history of civilization, indeed, is not the story of the deeds and misdeeds of kings and queens as it is usually presented to us, but is really the story of the development of the tools of production. This is recognized in a general way when we speak of the Stone Age, the Bronze Age, the Age of Iron, and the Age of Steel. It is possible that we shall develop another metallic basis that will serve as an exponent for a higher and happier plane of civilization.

The *distribution* of the fruits of industry and the consequent degree of universal comfort and well-being among any people for given natural resources and developed productive powers, are dependent upon the

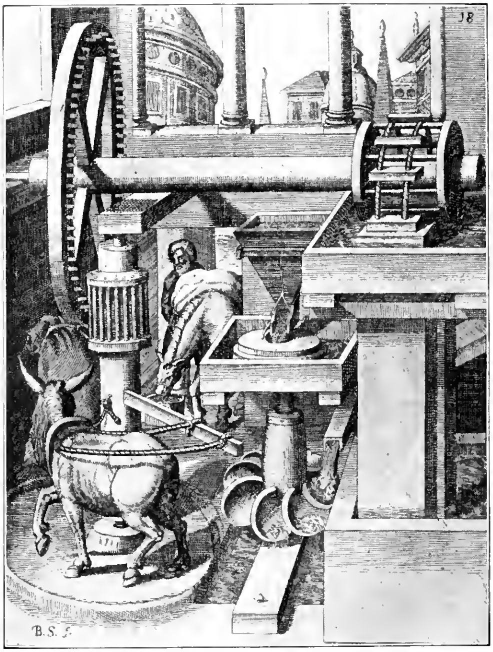


FIG. 1. A MEDIEVAL GRIST MILL
We cannot help wondering why the designer did not hitch the beast directly to the mill instead of using his animal power to lift water and then use the water to drive the mill.

industrial system under which production is conducted. Thus among the North American Indians, working with primitive tools, the distribution of wealth was fairly uniform. None were very poor compared to others. In the ancient Egyptian and Babylonian civilizations, on the other hand, where, also, the tools of industry were primitive and hence the output for each individual was very small, the larger part of what the worker produced was taken from him to support the nobility, the priesthood, and the army. And his output was so small, in general, that when he had contributed his share toward the support of the civilization of which he was a part, very little was left for him or his family, and the average well-being was very low.

Brief reflection will show that in any highly civilized country the economic condition of the actual producer tends to approach slavery, as his tools of production become more and more primitive, though the controlling or non-producing classes may enjoy a high state of civilization. History affords many examples of nations organized industrially in this manner, supported by vast numbers of low-paid producers whose economic state bordered upon or actually was that of slavery. It is easy, however, to conceive of civilizations possessing very highly developed tools of production and operating them by slave labor; though it is to be hoped that such an organization is no longer possible. "*Highly developed tools of production make possible a high average state of mental development and physical comfort; but the realization of this average depends upon mental ideals and the social and industrial organization by which the wealth produced is distributed.*"

Influence of National Ideals

It should be particularly noted that national ideals may greatly affect not only the distribution of wealth,

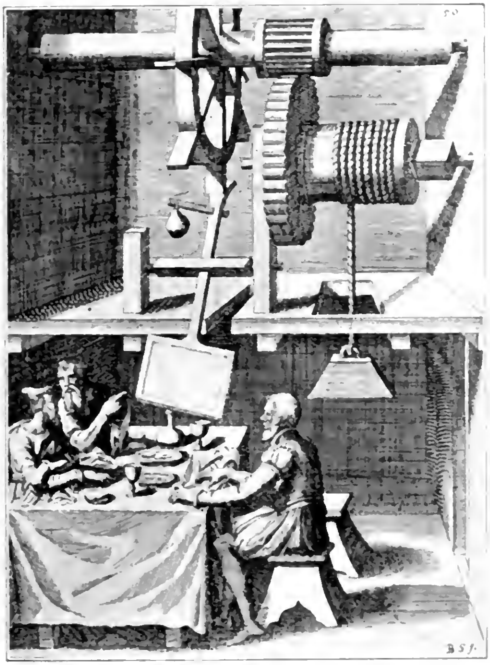


FIG. 2. A TABLE FAN OF 1611

The devices are familiar in principle but the mechanism as a whole is in striking contrast with the small electric motor-driven fan of today.

but also the industrial methods by which worldly goods are produced. Thus religious prejudices have often discouraged the use of valuable scientific inventions; or caste systems, as in India, may crystallize the industrial machinery and prohibit progress. In recent years, again, there have been many instances where practice and usage of long standing, [illegible] by the courts, have been swept away because of a change in sentiment. Our modern industrial compensation laws are a good example of such a change. Such national sentiment may interfere with the working of economic laws that in the long run would benefit humanity, retarding their influence because they may work an immediate hardship on those first affected. Obviously, therefore, production and distribution of wealth are closely interconnected. The first part of this series of articles, however, will deal primarily with the economics of production, while later articles will discuss certain phases of distribution.

So far as we know, all civilized peoples have passed through several fairly distinct stages of economic progress. For unaccountable reasons, other peoples have reached some one of these stages and have progressed no farther. Curiously enough this lack of economic progress does not appear to be attributable to lack of mental ability. The ancient Greeks have never been equaled for pure intellectual power in the field of philosophy or in skill of hand in sculpture, but they acquired only a very small knowledge of science either pure or applied. The scope of these articles forbids any extended discussion of these economic stages, but a careful study of them is most instructive to the student of industrial economics.

Five Economic Stages

The first stage is the *primitive*, or *hunting* and *fishing*, stage where life was supported by direct appropriation of natural resources. The North American Indians were in this stage when colonization from Europe began. In this stage tools are primitive and mostly of stone and wood.

The second stage is that of *pastoral life* when men had learned to domesticate animals and to depend upon them for food and clothing. The need of fresh pasture usually necessitates a nomadic life for such tribes. But accumulated wealth, in the form of herds, and even property rights to grazing lands, begin to appear, and slavery may also be instituted, captured enemies making this a possibility.

The third advance is the *agricultural stage* when men have learned to raise plants as well as animals. Nomadic life ceases and men settle down on definite tracts of land, thus crystallizing property rights in the land. Slavery may become more common since the need of manual labor is increased. Accumulated wealth increases so that a given piece of land will support a much larger population. Hunting and fishing may still be pursued as an adjunct to agricultural and cattle-raising. Division of labor begins to be more marked, especially in the production of tools, of wood and iron. The latter part of this period is marked particularly by the appearance of a class of independent wage-earners free from the soil to which all men are more or less bound during the agricultural stage. This movement marks also the beginning of the separation of agriculture and the mechanic arts into two great fields of endeavor which is such a marked characteristic

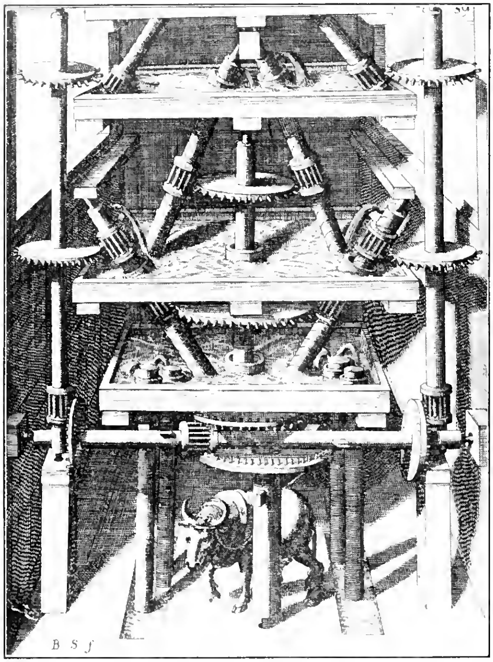


FIG. 3. A MEDIEVAL PUMPING PLANT
This machine which was proposed but never actually built was expected to use Archimedean spirals with a patient ox as the prime mover.

of modern industrial society. Division of labor, it should be noted, is the fundamental economic principle of civilization. It appears to be axiomatic that as the worker restricts his field of endeavor his product rises in quality and quantity.

Handicraft Industry

The fourth stage is that of *handicraft industry*. In this stage the separation of agriculture and the mechanic arts is more pronounced, independent trades are developed, and the principle of division of labor is greatly extended. Handicraft factories involving congregated labor may appear, and manufacturing centers, that are the beginning of modern industrial cities, begin to form. The need of capital in order to conduct larger enterprises begins to be felt. Commerce and transportation between different parts of the country and between neighboring states commences to give rise to the need of some medium of exchange, and money comes into extended use. Life becomes more complex, and legal regulations and restrictions intended to insure a more equitable division of the fruits of labor make their appearance. It should be noted that while factories and manufacturing centers exist in this stage, they are based upon handicraft tools; that is, the tools of production are still so simple and primitive that *the skill of the worker is still the predominating factor in production.* Ancient Greece and Rome are good examples of large and flourishing handicraft civilization. England and the leading countries of continental Europe, as well as the English colonies in America were in this economic stage until about 1750. The majority of humanity still support themselves by handicraft industry.

Machine Industry

The last (fifth) and highest economic stage is that of *machine industry*, which arose in England and continental Europe during the latter part of the eighteenth century. It spread to America and has been adopted by Japan, but is far from being universal. It is characterized by a tremendous development of the tools of industry in the way of machinery, the production of power to drive this machinery, the development of great factories where division of labor has been extended to unheard of limits. Transportation facilities have been revolutionized by steam and electricity, and transmission of intelligence quickened by the telegraph, telephone, and radiophone. Goods are produced in large quantities or by "mass production" as it is called. The business corporation has become the approved form of industrial organization and the modern system of doing business on credit, instead of by actual exchange of circulating medium, has greatly facilitated these great operations. This change in financial methods follows, necessarily, since "mass production" requires "mass financing." These two features of modern industry are highly developed, but they have brought about some very difficult problems. The art of administering these great enterprises or "mass management," as it may be called, is still undeveloped, and we have made little progress in distributing the fruits of industry in an equitable manner. The greatly extended use of division of labor has made the latter problem an exceedingly difficult one.

Three Factors in Productive Processes

The three great factors in modern productive processes are, therefore, agriculture, manufacturing, and transportation. These factors are interdependent, acting and reacting upon each other, and each presents its own economic problems. But since modern manufacturing methods have done so much to make modern agricultural life possible, and since they have practically created modern methods of transportation, these articles will be confined to a discussion of present-day industrial methods.

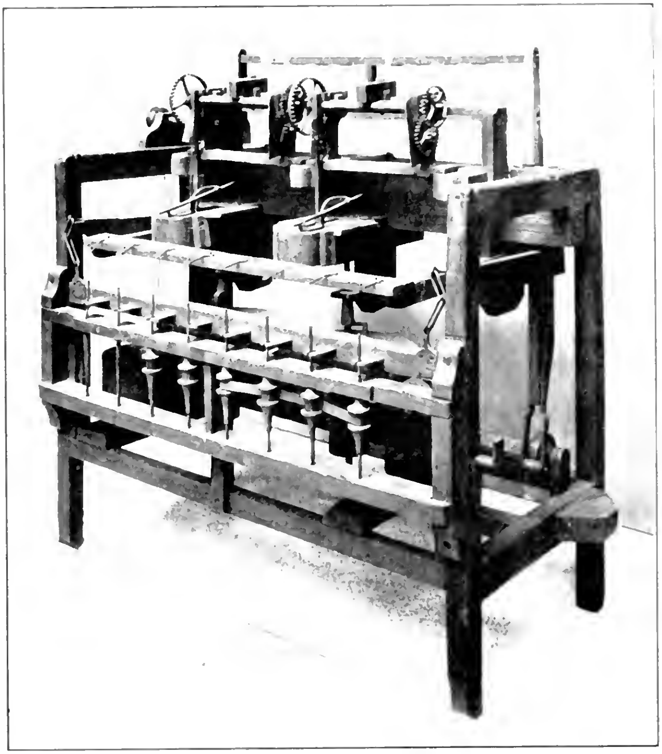
In order to understand the modern industrial field it is essential to know something of the industrial conditions prevailing at the time modern machine methods were introduced, and to know something about the economic and social conditions of the working population upon whom the results of these methods were imposed. England was almost wholly in the agricultural stage for three centuries or more, succeeding the Norman Conquest in 1066. The manorial system largely prevailed, under which all men were practically bound to the soil in communities, each governed by a "Lord of the Manor." The working population tilled the soil, produced the primitive tools of industry, supported the lord of the manor and followed him, if necessary, in time of war. The lord and nobles afforded protection against outside oppression. Each manor was practically self-sustaining and commerce was scanty. As this feudal system declined and the period of handicraft industry began to appear men found means of freeing themselves from the soil and, collecting in towns and villages, they practiced the handicraft callings. Division of labor was hence extended and trade and commerce became necessary.

Defence Against Industrial Oppression

Coincident with the growth of handicraft industry and of division of labor came the growth of the protective influences that men naturally organize to guard, if possible, against industrial oppression. The trade guilds, forerunners of our modern trade unions, and having many things in common with these later-day organizations came into being, and for several centuries dominated industry. The merchant guilds, corresponding to our modern chambers of commerce, or perhaps more closely to certain modern combinations of capitalists organized for mutual protection, also appeared. More striking still is the large amount and character of labor legislation that is found on the statute books of the Middle Ages. Thus the Statute of Laborers of 1349 fixed the working day at 12 hours *at least* and endeavored to fix a *maximum* or "reasonable wage." In general these ancient laws were aimed *against labor* and not in its favor as are modern enactments. The economic balance was entirely different than at present, and hence a different kind of protective legislation was in vogue. It should be noted, therefore, that there is nothing new in protective and regulatory measures such as we see today and one need not be surprised at what may appear at first sight as startling innovations of this kind. They had their origin and application many generations ago.

Three Forms of Handicraft Industry

By the year 1700 and just prior to the advent of the modern industrial era, handicraft industry was quite well developed in England. It appears to have existed in three forms. First there still survived a large number of *individual* handicraftsmen. In fact these have not as yet become extinct in England and survive in America in the form of custom tailors, dressmakers, job carpenters, and similar artisans. Second there was the Domestic System of manufacture under which the artisan tilled a small piece of soil as his principal occupation, but occupied his spare time in manufacturing. In the textile industry, which was still the great



In the South Kensington Museum

FIG. 4. THE WATER FRAME OF ARKWRIGHT

This is one of the original machines of the four great inventions of the end of the Eighteenth Century, having been made in 1771. It made roller spinning a practical success and the name of its product still survives as "water twist."

manufacturing calling, neither of these classes in the main owned the materials on which they worked, though they owned the tools of production. The materials were supplied by a middleman who contracted with the artisans to do a given part of the productions as, for instance, spinning, and then carried the product on to some other worker who would do the weaving. This, it will be noted, was the beginning of our present system of middleman, and long before the present era of machine production we find the workers and even statesmen crying out against the evils of this capitalistic system, particularly where the conditions of manufacture were fixed by law and monopolies were granted by royal authority to favored individuals or companies, giving them control of a given industry. A study of this period and its problems is very instructive as viewed from present-day conditions. Lastly, there were a comparatively small number of handicraft factories embodying all the principles of modern factories, except that the tools were handicraft implements. One of these textile factories employed 1000 persons and produced cloth from the raw wool, thus taking advantage of *congregated* labor, as modern factories do, and representing very closely modern capitalistic methods.

The growth of governmental regulation of trade and manufacturing is an interesting and important phase of the later days of the handicraft period. The supervision of industry formerly conducted by the guilds or by towns was superseded by a national system of regulation that has been called the Mercantile System. It was operative in England from about the sixteenth to the nineteenth centuries and in its essence aimed to regulate manufacturing and commerce so as to increase the commercial and military power of the nation. Not only did this policy aim to direct the larger affairs of the nation, but it interfered, also, with internal matters endeavoring to set prices, wages, apprenticeship rules, and other details of industry in a very arbitrary manner that would seem out of place today. These regulations were, of course, justly complained of, and in the case of the Navigation Acts so familiar to every American school boy met with strong and determined resistance from some of the colonies.

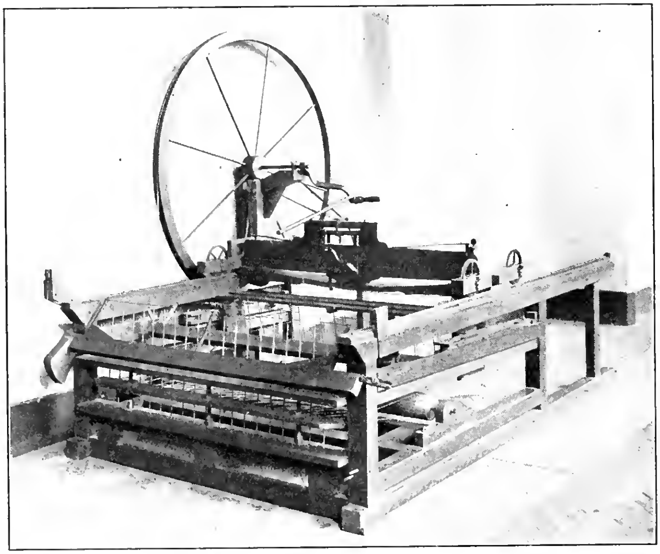


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FIG. 5. A REPRODUCTION OF HARGREAVES' SPINNING FRAME

This view is from a reproduction of one of the four great inventions of the end of the Eighteenth Century. For this machine the British government granted a prize of £50 as a mechanical development which promised to increase foreign trade.

Condition of the People Under Handicraft

On the whole, however, the condition of the working population was fairly good for an era of handicraft production. Labor was in demand and its products found a ready sale. It enjoyed a large measure of personal liberty and independence, the implements of industry being much more easily obtained than today. These apparently satisfactory conditions have been much exaggerated by writers and poets who have sung of this "Golden Age" as one of pastoral delight and content. Judged by modern standards the condition of the common people was wretched indeed. "Housed in unsanitary hovels, uneducated and loose in morals, a prey to epidemics and plagues, their conditions would be envied by few workmen today." And it should be particularly noted that at this period they were practically without protection from industrial aggression. The old guilds had disappeared and such legislation as existed was aimed to make their burdens more difficult instead of giving them protection. It was upon the heads of such people that the new industrial era broke with the fury of a great storm.

Persistence of Primitive Tools

As has been noted it is difficult to explain why civilized man was so long content to use primitive handicraft tools without making an effort to improve them. The textile implements in use in 1700, namely, the old-fashioned spinning wheel and hand loom had existed in the same form or similar form for many thousands of years. At best, invention is a slow process,

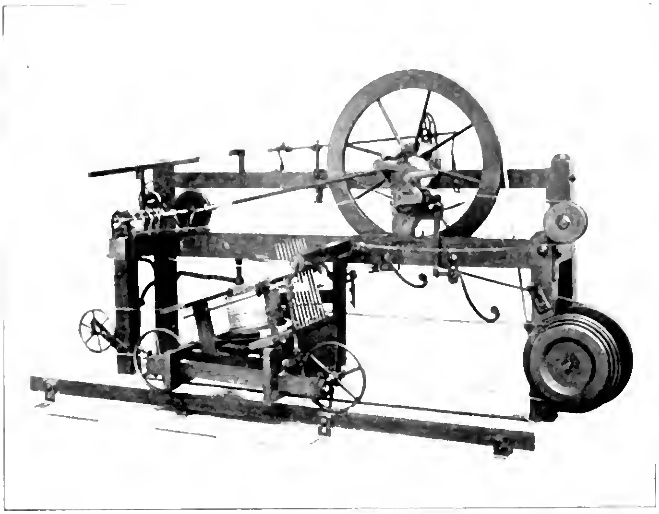

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FIG. 6. A REPRODUCTION OF THE CROMPTON SPINNING MACHINE OR "MULE"
This machine combined the good features of its predecessors (see Figs. 4 and 5 and is the third of the four great inventions. It is the prototype of the modern spinning mule and was built in 1779.

and though men began to think about more improved textile machinery about 1700, it was not until the latter part of the century that marked changes appeared. The immediate cause of this new development lay in the desire of the British government to increase foreign exports and to that end it had offered prizes of 50 and 25 pounds, respectively, for the first and next best improvement in the art of spinning. This offer, small as it may seem to be, appears to have stimulated inventive efforts greatly, and these efforts culminated near the end of the eighteenth century in what are commonly known as the "Four Great Inventions."

The Great Textile Inventions

In 1770 James Hargreaves, a weaver, patented the "spinning jenny," which consisted of a number of spindles side by side and actuated simultaneously so that several threads could be spun at once. In 1771 Richard Arkwright, originally a barber, made roller spinning, so-called, a practical success, and operated his machines by water-power, whence the name of his product "water-twist" still survives. In 1779 these inventions were superseded by the invention of the "mule" (the predecessor of the modern spinning mule), by Samuel Crompton, a spinner. Crompton's machine combined the good features of his predecessors and was so named as being a hybrid offspring of these former inventions. And finally in 1785, the power-loom was patented by Edmund Cartwright, a Kentish parson, giving to the weaving industry what these preceding improvements had given to the spinning trades.

Undoubtedly these inventions, of themselves, and in connection with water power, would have greatly changed the textile industries and would have shown the way to marked improvements in all lines of handicraft. But the invention of the steam engine in 1769, greatly accelerated the change. This new motor made possible unlimited power and permitted a choice of location that allowed these new methods to spread with great rapidity and to drive out the old handicraft methods with almost destructive violence. This very significant change in manufacturing methods, and the social changes that accompanied it, are known as the "Industrial Revolution." The principles involved were first applied, as noted, to the textile industry; but they spread with astonishing speed to all other handicraft industries, changing them or even replacing them entirely with new and much more efficient methods. The exact technical character of these inventions and the social changes involved in their application will be discussed in a succeeding paper.

The British government was quick to see the great advantages of these new tools of production, and, acting under its legislative control of trade and industry, strove hard to prevent the exportation of machines or drawings that would permit even the colonies to obtain

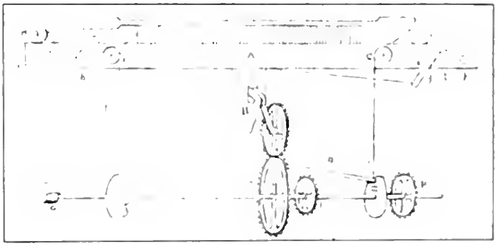

FIG. 7. MECHANISM OF THE CARTWRIGHT POWER-LOOM, 1790
This is the last of the four great inventions and started the same development in the weaving industry which the three spinning machines, of Figs. 4, 5, and 6, had initiated in spinning.

possession of the new methods. In spite of these efforts, however, Samuel Slater, a young Englishman who had acquired a knowledge of the Arkwright machine, migrated to America in 1789 and under the direction of Almy and Brown of Providence built the first successful cotton factory at Pawtucket. This old building still stands, and Slater has become known as "the father of American industries."

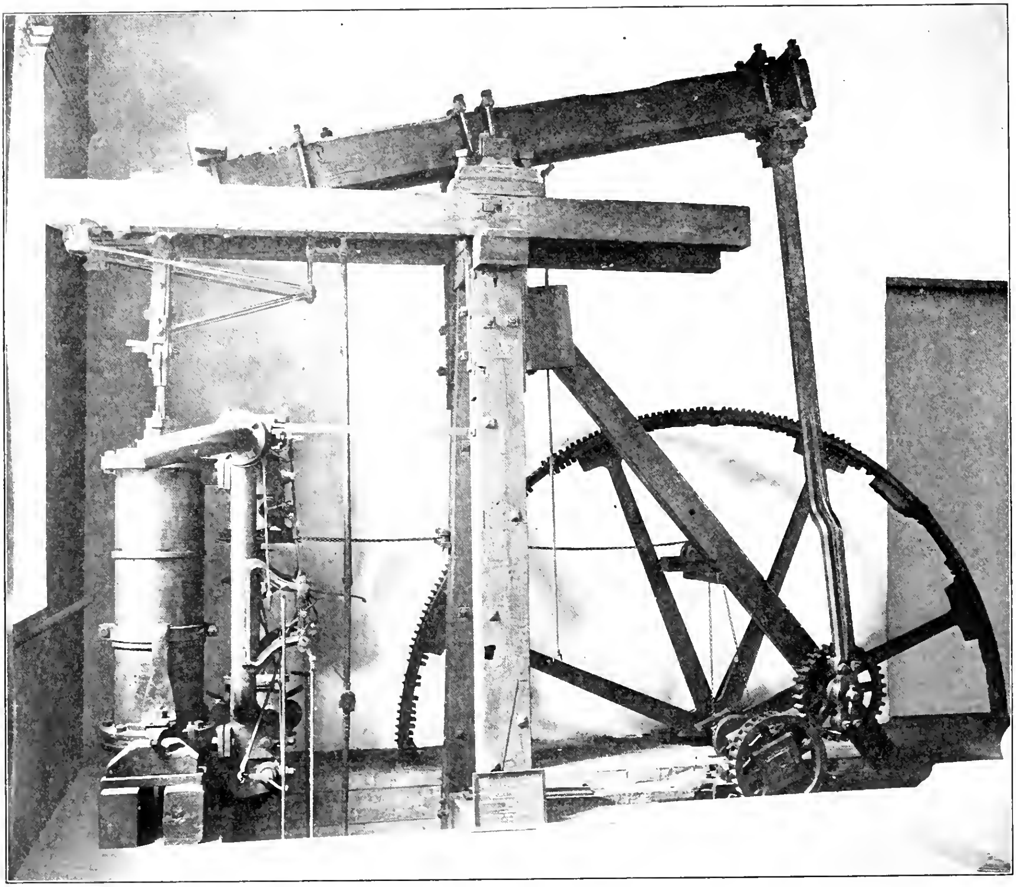

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FIG. 8. WATT'S STEAM ENGINE OF 1788, THE FIRST TO USE THE SUN AND PLANET GEAR

This machine is of great historical interest, being one of the first steam prime movers built. It has a long vertical cylinder, a walking beam, and a long connecting rod attached to one of the gears of the sun and planet train. For some reason, when this engine was built Watt could not use a crank.

The effect of the new inventions upon American industry was nothing like that exerted upon English manufacturers. American manufacturing industries had hardly got under way, so that the introduction of these new machines did not displace handicraft industry so rapidly, or to such an extent, as to bring about the direful social conditions that resulted in England and which will be described later in more detail. Besides, land was to be had almost for the asking, and no man was compelled in the beginning to work in a factory. But while we have escaped many of the evils incident to the sudden imposition of these new methods upon an old-established handicraft industry, we have not, nor can we escape certain inevitable results that are inherent in the new system and which if not met and combated will leave us, of all men, most miserable.

Any industrial system of which we have record that involves extended division of labor so that men become more and more mutually dependent upon each others' efforts appears to create hardships for some classes of people. The new industrial methods have pushed division of labor and capitalistic control beyond anything this world has ever seen. We have escaped certain difficulties incident to the *introduction* of these new methods, but we shall not escape the *ultimate problems* they present. Incidentally, it will be interesting to watch nations, such as Japan, that are even now adopting these new methods, and superimposing them upon an ancient handicraft. Shall they be able by studying the industrial history of England to avoid a repetition of the immediate results of the Industrial Revolution?

(To be continued)

Industrial Profits and Labor Shortage

By W. RANDOLPH BURGESS

Manager, Reports Department, Federal Reserve Bank of New York

A THREE-CORNERED paradox is found in the present labor situation. There is evidence for three statements which apparently are mutually antagonistic:

1. Factory output is equaling, or exceeding, all previous records.
2. There are 10 per cent fewer workers employed in industrial establishments than in 1920.
3. There is an acute shortage of industrial workers.

Each one of these statements appears in a measure to contradict the other two. The questions immediately arise: How can there be an acute shortage of workers when the number employed is much smaller than in 1920? Where have the 1920 workers gone? How can output reach new high records with undermanned factories?

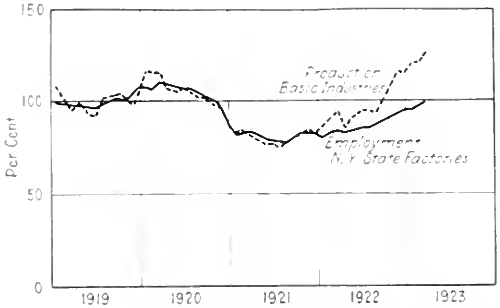


FIG. 1. VOLUME OF PRODUCTION IN 22 BASIC INDUSTRIES COMPARED WITH THE NUMBER OF EMPLOYEES IN NEW YORK STATE FACTORIES

1919 average = 100 per cent. Allowance is made for usual seasonal changes.

To demonstrate the fact basis for the first two of the statements there are reproduced herewith diagrams illustrating the relationship between factory output and employment; first for all types of manufacturing, and second for the iron and steel industry. In Fig. 1 is shown an index, prepared by the Federal Reserve Board, of production in 22 basic industries throughout the United States. In making up the index, output figures for different industries are weighted in accordance with their relative importance, and the figures have been adjusted to eliminate changes due to usual seasonal causes. The line probably represents with reasonable accuracy the general movement of basic production. The line representing employment is taken from the reports of the New York State Department of Labor, and shows the number of workers employed in New York state factories. This is probably the best available index of factory employment, and moves in close correspondence with those more fragmentary indexes of employment which are available for the country as a whole. The industries of New York state are so varied as to be largely representative of the nation's business.

The diagram (Fig. 1) shows that production in these lines is now 25 per cent above the 1919 monthly average, while employment is just about even with 1919 figures. Production has increased more than 65 per cent from the low point of 1921, but employment has increased only about 30 per cent. The truth of the general relationship between production and employment shown by Fig. 1 has been tested for a number of individual industries for the country as a whole. As an illustrative case, the figures for production of pig iron and employment in the iron and steel industry are shown in Fig. 2. The railroads, automobiles, and other industries tell the same story of output well up to that of 1920, and employment well under that of 1920.

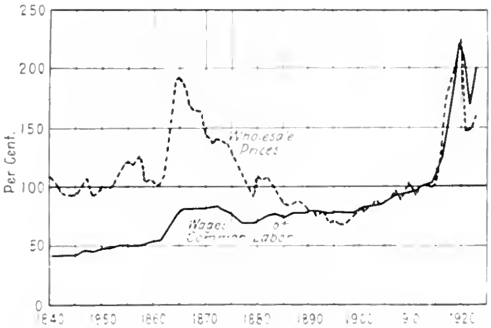


FIG. 2. PRODUCTION OF PIG IRON COMPARED WITH THE NUMBER OF EMPLOYEES IN THE IRON AND STEEL INDUSTRY

1919 average = 100 per cent. Allowance is made for usual seasonal changes.

The existence of a real shortage of labor is evidenced by figures recently compiled by the National Industrial Conference Board from about 1000 different industrial concerns employing over 370,000 workers. Of the 1000 concerns, 315 reported unfilled positions due to inability to secure workers. Total unfilled positions amounted to 2.5 per cent of the total number of workers employed by the 1000 concerns, and the report refers to this as a 2.5 per cent labor shortage. Shortages of common labor and female labor were more pronounced than shortages of skilled labor. Incidentally the returns confirmed the facts of employment shown in Figs. 1 and 2. Current employment by these concerns was well under 1920 figures.

Of course we do not know exactly what a 2.5 per cent shortage of labor means, because we have never before tried to measure labor shortage in that way. We do not know whether such a shortage can be met by industrial readjustment or by the shift of workers between occupations. If we become accustomed to measuring labor shortage in terms of percentages, it may be possible to predict the real pressure for workers, which a 2.5 per cent shortage means.

Perhaps a better measure of the pressure for workers at present is contained in wage figures, which show the balance between supply and demand. On the basis of practically any wage figures one cares to select, there is at the present time a genuine shortage of many types of workers. In the past year the wages of unskilled labor have risen from about $18 to about $22 a week, or more than 20 per cent, and the average weekly earnings of factory workers have risen more than 10 per cent. In fact the wage swing has been consistently upward during the past few months among almost all groups of workers. The evidence appears to indicate a genuine shortage of industrial workers.

We are faced with the problem of harmonizing a shortage of workers with the fact that the actual number of workers employed in factories is some 10 per cent less than in 1920. The question is, where the 1920 factory workers have gone. Because of the restriction of immigration we have gained less workers since 1920 than the normal gain of previous years, but nevertheless the population has continued to increase at a steady rate, and there should be available several hundred thousand more workers in 1923 than there were in 1920.

There are two explanations for this situation that need to be carefully examined. In the first place there is the possibility of workers having shifted from factories to other types of occupations, and in the second place there is the possibility of a social change in the population such as to reduce the number of wage-earners in proportion to the entire population.

Shift to Building Trades

There has undoubtedly been one considerable shift in workers since 1920; a shift from industry to building construction. In the year 1920 the high cost of building materials and high wages drove the cost of building operations to a point from two and one-half to three times as high as before the war. This high cost of building, together with difficulty in securing an adequate supply of materials and labor led to a sharp curtailment in the volume of construction. A computation of the volume of building shows construction in 1920 little more than 50 per cent of an estimated normal figure. The present building boom, in contrast, has carried construction to a point more than 50 per cent above the normal amount. If allowance is made for changes in the cost of building, the current rate of contract awards calls for a volume of new construction in 1923 not far from three times as large as in 1920. Apart from changes in the efficiency of labor, there would now be required in the building trades something like three times as many workers as in 1920, and many of the additional workers must have been drawn from industrial establishments. There are normally employed in factories a considerable number of carpenters, iron workers, and other artisans. There is normally a seasonal shift of workers between manufacture and construction. The shift in the past year has been exceptionally large, and although there is no way of securing accurate figures, it is not improbable that as many as a million workers may have shifted from industry to building in the past two years.

According to the census of manufacturers of 1919 there were in the neighborhood of 10,000,000 workers employed in industrial establishments in the United States. One million drawn away from this number into building would mean a reduction of 10 per cent, and would account for a considerable part of the reduction in factory employees between 1920 and 1923. Fig. 1.

Social Factors Affecting the Labor Supply

A second factor, apart from the shift of workers in building construction, which may help to account for

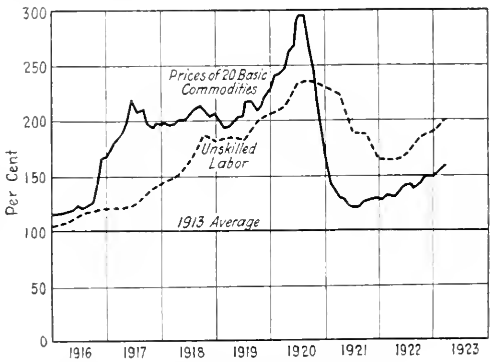


FIG. 3. WAGES OF UNSKILLED LABOR COMPARED WITH PRICES OF BASIC COMMODITIES

1913 average = 100 per cent.

the present labor shortage at a time when factory employment is less than in 1920 may be found in an examination of social changes in the population. The supply of labor in the United States is a more elastic thing than we have been accustomed to think it. This is

PERCENTAGE OF POPULATION 10 YEARS OF AGE AND OVER ENGAGED IN GAINFUL OCCUPATIONS

YEAR	PER CENT OF MALES EMPLOYED	PER CENT OF FEMALES EMPLOYED	PER CENT BOTH SEXES EMPLOYED
1880	58	11	35
1890	60	13	37
1900	61	14	38
1910	64	18	42
1920	61	17	39

indicated by the figures in the table on page 26 taken from census publications, showing the percentages of the male, female, and total population, of 10 years of age and over, which have been gainfully employed, in the different census periods.

From the time of the Civil War to 1910 there was a continuous tendency for more women to enter industry. In 1880 only 11 per cent of the women 10 years of age and over were reported as gainfully employed, while in 1910 there were 18 per cent. There is an element of deception in these figures, because in the early days the woman who labored on the farm as hard as the father of the family was not listed as gainfully employed, whereas her descendant who works in the factory is so listed. But it remains true that there has been a considerable increase in the ranks of industrial workers through the entrance of large numbers of

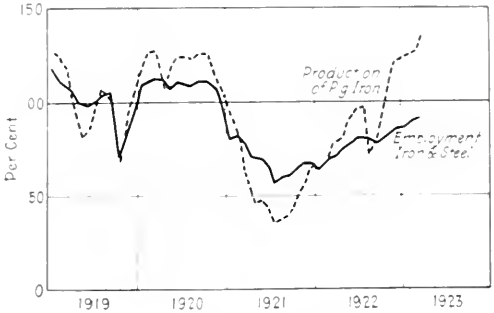


FIG. 4. WAGES OF UNSKILLED LABOR COMPARED WITH PRICES OF BASIC COMMODITIES
1913 average = 100 per cent.

women. There is some indication in the census figures for 1920 of a decrease in the proportion of women who are employed, and the decrease is most marked in industrial occupations. There is evidence of a shift to sales and clerical work.

A second social movement tending to restrict the number of workers available for industry is the lengthening of the period of school attendance for young people, and a lifting of the age at which they enter industrial pursuits. This movement has been going

PERCENTAGE OF SCHOOL ENROLMENT TO TOTAL POPULATION 5 TO 18 YEARS OF AGE

YEAR	PER CENT ENROLED IN PUBLIC SCHOOLS
1871	61
1880	66
1890	69
1900	72
1910	73
1920	78

forward for many years as is indicated by the table above, showing the percentage of the population 5 to 18 years of age actually attending school.

There are no comprehensive figures for the period from 1920 to 1923, [illegible] school enrolment, an estimate [illegible] shows that in 1921 when employment was difficult to find, the school population was greatly increased. It has long been the experience of schoolmen that there is little pressure for the erection of new school buildings in periods of prosperity, but that in hard times there is always a shortage of desk space. The increases in school population which have taken place in hard times have usually been retained in later periods of prosperity.

It is not possible to summarize statistically the effect of these and other social factors on the available supply of labor for industry, but it seems probable that the tendency has been to restrict the supply. In any event these social factors cannot be neglected in any summary of employment conditions, and any industrial concern which is facing a labor shortage does well to inquire in its own community as to the potential supply of women workers and the movement of population of school age. In these directions the supply of labor is most elastic.

Fewer Workers—More Work

Thus far we have been concerned with an explanation of the coincidence of a labor shortage with a smaller number of workers on factory pay-rolls than in 1920. We now turn to a second paradox, the coincidence of a high rate of industrial output with employment well under 1920 figures. To put it another way, we have to explain a considerably higher output per man per day. It is worth noting in the first place that two factors in the present situation have exercised a tremendous pressure for greater efficiency in manufacturing operations. The first of these factors has been high wage rates. While the prices which the manufacturer charged for his products fell 30 to 50 per cent between 1920 and the end of 1921, factory wages fell on the average less than 20 per cent, and in order to secure any profit, it has been necessary for the manufacturer to cut his wage bill per unit of output. The present labor shortage has provided a second motive for increased efficiency, and the result has apparently been an output of manufactured goods about equal to 1920 by a 10 per cent smaller number of workers, or, to put it another way, an increase of 10 per cent or thereabouts in efficiency. This fact is indicated by Figs. 1 and 2, and is further supported by the evidence of large numbers of manufacturers. Automobile tire factories used to turn out one tire per man per day, while the present standard of accomplishment is nearer to 3 tires per man per day. The Ford plant is reported to be turning out between 6000 and 6800 cars per day, with about the same number of employees that it took to turn out 5000 per day. These are somewhat exceptional cases, but it is quite common for manufacturers to testify that their efficiency has increased 10 or 20 per cent since 1920.

The methods by which this increased efficiency has been effected are in the main of four types. In the first place, the industrial depression of 1921 resulted automatically in an increased efficiency, because the workers were anxious to retain their positions; in the second place, efficiency has been increased by improved management which has studied work processes, cut out unnecessary steps, and given workers better training for their jobs; in the third place, more incentives have been offered for efficient work in the form of special bonuses, or changes in methods of wage payment; and in the fourth place, labor-saving machinery has been adopted. A number of concerns have adopted the practice of installing labor-saving devices even if there is no saving in money, in order to release employees for other work.

The effect of increased efficiency in the past few months has been to bring business profits back to a reasonable rate of earning on capital invested. The Federal Reserve Bank of New York recently made a tabulation of the 1922 earnings of representative industrial concerns, which indicates that in the year 1922, profits of these concerns were more than 3 times as large as those in 1921, and were approaching in volume the profits of 1919 and 1920. If figures for the last quarter of 1922 or the first quarter of 1923 were available, they would almost surely indicate a rate of profit as large as in 1919 and 1920.

Profits, Prices, and Wages

In 1923, however, the problem of making profits has become more acute. The general level of wholesale prices at which manufacturers may sell their products has risen more slowly than either wages or the prices of raw materials. The increase in the costs of production is illustrated in Fig. 3, showing prices of 20 basic commodities and the hiring rate for unskilled labor. The trend of basic commodity prices may be taken as typical of prices of the raw materials which manufacturers must use, and common labor wage rates constitute the largest item in a number of industries, while in others they may be taken as an index of the tendency of wage changes. The common labor wage rate represents the open market price of labor; it moves faster and further than other wage rates, and is an exceptionally good barometer of wage changes.

The manufacturer of today faces the problem of keeping the selling price of his product within the range which the consumer will pay, while he faces rapid increases in the prices of his raw materials, and in the wages which he must pay. In some lines the problem is being met by the substitution of cheaper for more expensive raw materials, but in general the situation can only be met by retaining at least the present rate of labor efficiency, and, if possible, reaching a still higher rate. The situation is made still more difficult by the fact that the incentive to efficiency which prevails in a period of unemployment has disappeared.

The manufacturer today is confronted with a problem of management, in some ways more serious than any he has had to face since the Civil War.

Some light on the nature of the current problem is shed by an inspection of the movement of wages and prices in this country in the past 80 years. The figures are plotted in the accompanying diagram (Fig. 4). Prices and wages are both quoted on an annual basis.[1]

[1] The price index is a composite of indexes prepared by Juergens, Mitchell, and the Department of Labor. Wage figures are from Burgess, "Trends of School Costs," brought to date by a compilation by the Federal Reserve Bank of New York.

The feature of the diagram which immediately strikes one is the manner in which wages have been moving upward almost continuously since 1840, while the long-time trend of prices has been practically level with the exception of the two war periods.

At the time of the Civil War, both prices and wages rose, although prices moved somewhat faster and further, but after the war was over, prices rapidly receded, and their movement was continuously downward for nearly 30 years. The wage level, on the other hand, changed much more slowly, and after a temporary dip, returned to the high level reached during the Civil War. The net result was a far higher wage level in proportion to the price level than before the war.

This relationship leads to two observations; first, higher wages for workers accompanied by low prices meant a general increase in the standard of living in the United States. They meant better food, better dwellings, better clothing, better education, better streets, in fact, a higher standard of comfort and civilization.

A second observation is that in one way or another, industry adapted itself after the Civil War to paying a high wage rate, while the prices of the products manufactured gradually fell to lower levels. This was made possible by the introduction of factory methods on a large scale, and by the opening up of considerable land areas throughout the West, but the important thing to notice is that it was accomplished. Something the same movement of prices and wages took place after the Napoleonic wars as well.

What of the Future?

For a span of years to come there is likely to be tremendous pressure for greater factory efficiency. It may seem difficult to conceive an increase in efficiency as great as occurred after the Civil War with the introduction of large-scale output. Yet in the industrial experience of the past few years there is found reason to believe that a corresponding increase in efficiency is not at all impossible. The principles of quantity production are now being applied on a scale not before dreamed of. In the invention of labor-saving devices the present era is as fruitful as any of the past. Most of all, under the pressure of labor scarcity and high wages, we are learning to arrange working conditions so that each workman may be able to do his best work. The adjustment of working conditions includes attention to ventilation, rest periods, social relationships, proper incentives, and in fact all of those elements which are grouped under the general term management.

In the long-time outlook there seems every reason to anticipate such an increase in factory efficiency as will make possible high wages and a high standard of living for the worker along with a reasonable level of prices.

For the immediate future—the coming months of 1923—the probability is not so clear. Increased efficiency can as a rule only be achieved slowly. This much can, however, be said with some degree of assurance; that the industrial concern which is most successful in increasing its rate of output per worker is most nearly in line with the demands of the present and future and most likely to fulfill its purpose.

How the Walworth Company Looks Ahead

II. Determining the 1923 Sales Dead Line and Quota

PART II

By JOSEPH H. BARBER

Staff Assistant to the President, Walworth Manufacturing Company, Boston, Mass.

Class Number

658.8(01) Sales Analysis
338.97 Forecasting Production

THE analysis presented in the first part of this article[1] has considered the probable increase in the total demand in our markets in 1923 through the normal development of business cycle and other general conditions. The probable total having thus been defined, it is a more simple matter to discover next the proportionate part which each month of the year should contribute to the year's total, and subsequently to determine the proportions in which each sales unit should contribute to the total of the year and to the total of each month of the year. The analysis to discover the probable total contribution of the several calendar months to the grand total for the year comes next in the order of solution for three reasons:

1. The requisite analysis for the determination of the monthly total sales of the combined units is but an extension of the analysis which suggested the probable magnitude of the annual total sales of the combined units.
2. The determination of the probable monthly total sales of the combined units must precede the fixing of the monthly sales totals for the individual sales units.
3. The anticipation of the probable trend of total monthly sales requirements upon production facilities is of immediate importance because of its bearing upon initial production policies.

RULE-OF-THUMB methods no longer serve for successful business. The present article describes the scientific methods used by one manufacturing concern to predetermine its sales. This not only gives a definite basis for its general activities but also establishes standards for the guidance of its sales department and for the classification of its sales force—the separation of the mere "order taker" from the real salesman.

The similarity of the cycle action of the sales index line in the comparable cycle years shown in Fig. 3, is perhaps no less obvious than the consistent seasonal fluctuation of the monthly plotting points, first above and then below, that sales index line. At first glance, this consistent seasonal fluctuation about the trend line is noticeable in all years; it might, upon first thought, seem the proper initial step to discover the average per cent by which certain outstanding months, such as for instance those of January and February, are consistently below the line, or, on the other hand, by which October or November are above the line, and thus to discover percentage variation factors whose application to the extended trend line would predict the monthly sales totals more or less likely to be attained during 1923. The calculation, however, while not so simply accomplished, is nevertheless not involved, nor elaborate.

Upon a second review of the seasonal areas in Fig. 3, it will be noted that all first half-year areas of the second type year have in common many characteristics of shape and extent, though differing in these respects from the first half-year areas of the third type years—which latter areas, however, when compared with each other, likewise have in common many characteristics of shape and extent. This same thing is true with respect to the last-half-year seasonal areas in the two sets of comparable cycle years.

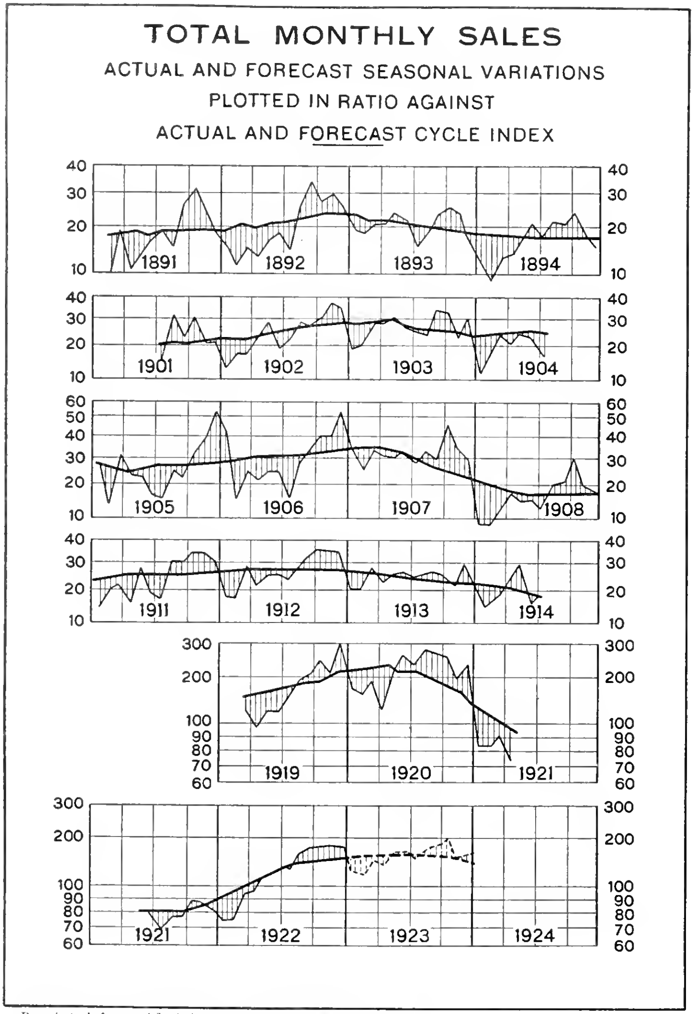
The statement was made in the earlier article, and it is obvious from both Figs. 2,[2] and 3 shown in the first part of the present article, that the average of all years is not at all like any particular year. Moreover, it is now obvious that even when seasonal variation is referred against the trend line for its current year, the seasonal variation average of many years would not be representative of the actual variation of any particular year. On the other hand, in all third-type years there is a good family likeness between all first-half-year areas and between all second-half-year areas, the variations being caused largely by the differences in severity of decline in the index curve. Accordingly, with such a consistent likeness in seasonal variation areas in the years resembling 1923, we may with some assurance superimpose similar areas upon the extended 1923 trend line.

[1] *Administration* for June 1923, p. 659.

[2] See *Administration* for June 1923, p. 664.

Factors Affecting 1923 Monthly Totals

This step might be taken at once, but for several modifying factors, the most important of which will be suggested. The trend line sustained throughout 1923 will tend to throw a greater percentage in the later part of the year than in any previous like year. On the other hand, the production policy effective in 1923 may result in a peak in the billings curve closely following the anticipated spring peak in the orders curve, and such an action, contrary to previous precedent, will tend to throw a greater percentage of the year's business into the early part of the year. It will be further noted from Fig. 3, that since 1921 each seasonal area represents a lesser seasonal fluctuation than occurred in any similar season of any comparable cycle year. This is true because our monthly billings line more closely "hugs" the trend line, due to a number of causes; for instance, greater diversity of product, wider dispersion geographically, and a larger percentage of distribution through retail outlets. Perhaps the most important factor in developing a smoother billings line is our greater success in anticipating demand with sufficient assurance to justify production for inventory in advance of actual demand.



Reprinted from Administration, June 1923, p. 667.

FIG. 3. CHART SHOWING TOTAL MONTHLY SALES

In concluding this phase of the discussion it will be recalled that our inferences, drawn by analogy from the past records of total sales, were utilized only in so far as such utilization proved valid for 1923 forecasting. Similarly, here, in consideration of further inferences by analogy, "rules" as to past seasonal variations are not directly applied in forecasting 1923 seasonal variations; on the contrary, these "rules" influence the forecast to the fullest extent only when imagination has discovered and judgment evaluated every reason why the "rules of the past" should not operate in the future. Upon conclusion of such analysis and adjustment, therefore, there evolve the 12 monthly dead-line amounts, plotted on Fig. 3, the 12 monthly contributions to the dead line grand total for the full calendar year 1923.

The 1923 annual total sales of the combined units has been broken down in longitudinal section, that is, through the length of the calendar year. The next step in order, before we can establish the final individual sales unit monthly dead-line amounts, is to break the annual total down in cross section, that is, into individual unit annual total amounts. These individual amounts, contributed by the units to the annual total, will be in proportions bearing a direct relation to the proportions contributed by the respective units to the annual total sales of previous years.

While the relative, or percentage, standing of each sales unit in past years may be readily calculated and graphically portrayed, careful observation will disclose significant variations in the relative standing of each unit. In our organization, it is clear that certain units, as the years are passing, are assuming a greater relative importance within the marketing organization. Consequently, other units are gradually surrendering their earlier higher percentage standing as a result of progress by new units now forging ahead not so much through superior management, as through development of more virgin territory, or, possibly through operation of economic laws. On the other hand, there is no infer-

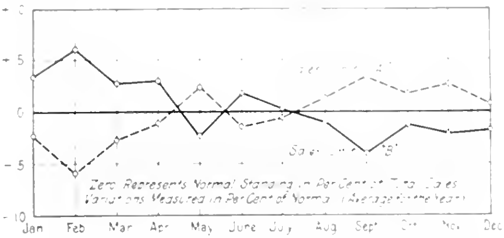


FIG. 4. AVERAGE SEASONAL VARIATION OF TWO TYPICAL SALES UNITS

In percentage standing relative to total sales of all units.

ence that the unit, which appears to be suffering by the ascendancy of other and newer units, is not of itself progressing at a profitable and therefore a satisfactory rate. As a rule it simply means that the newer units, by their more rapid initial expansion are causing the total sales of the company to expand at a rate more rapid than any rate possible of maintenance by the long established unit in a tried and true territory.

At this point there must be a partial merging of the local manager's viewpoint of future opportunity for business and the management's viewpoint as to the share of business that their reasoning would suggest as probably derivable from the local territory. In other words, the unit's annual deadline amount, in percentage of deadline total for the year, must approximate the percentage of total quota represented by the unit's quota assignment (which, it will be remembered, is influenced by the unit manager's own estimate). Here again is opportunity for wise adjustment of ratios derived from past records before they are applied in future estimating. Some thought has already been given to the influences tending to cause one unit to advance a greater percentage ahead of 1922 than others may be expected to advance. For instance, the increased activity of the oil industry will be reflected most definitely by increased sales in the Western Division. Likewise, because our foreign markets were not developed to the limit before the depression, the export division has an unusual opportunity to grow faster than the average growth of the company as a whole. In addition, there are other conditions, for instance, the completion of a new local warehouse for one branch, and the installation of a new plumbing department in another, all of which must be [illegible] permitted to influence in proper degree the ratios which [illegible] for breaking down the 1923 annual total on a dead line basis, to the year's total dead line amounts for the individual sales units.

In approaching the final step in the analysis we bear in mind the first quota ideal, which insists that the contestant should at all times sense his power to attain the reasonable standard. This ideal must find application in the monthly as well as the yearly assignments, for the reason that, while the salesman with optimism anticipates that which is yet to be, nevertheless he lives very much in the present. This fact demands recognition in quota setting. The goal which stimulates his present effort is a goal near at hand and possible of early attainment; then, with the interest still keen, new and higher goals may urge him onward. The "go-getter" salesman will not be greatly stimulated to action in the early months of the year by the assurance that his full quota allotment for the year will be attainable before next Christmas. He must know at once what standard must be met in this and each succeeding month, so that he may pass each mark with the strengthening assurance that his work is well done, that his efforts are recognized now, and that his current results, should they prove a little discouraging, will merge with the happier results of earlier months in a fair year-to-date comparison with his fellows.

Fig. 4 presents two typical curves of average seasonal variation (percentage deviation from "normal" ratio standing relative to total sales of all units) which we find evidenced in the sales records over a period of years. While any "year's average percentage standing" misrepresents the actual percentage standing in particular months of that year, nevertheless the "percentage deviation" from "normal standing for the year" has proved very consistent. Moreover, although a particular unit's normal standing for the year may vary from its standing in the previous year, it is still true that the deviation percentages fairly represent the percentage deviations from new normals in like calendar months. This is true because the seasonal variations of a particular unit are caused almost wholly by the na-

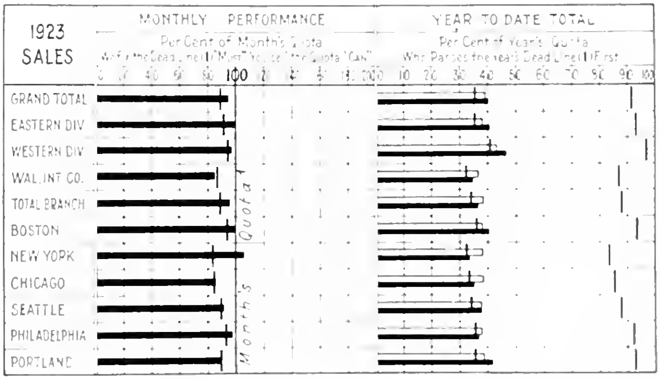


FIG. 5. GRAPHIC MONTHLY REPORT WITH FICTITIOUS MAY SALES FIGURES

ture of the sales unit's customer demand—for instance, whether largely jobber or largely consumer—and are very little affected by any secular trend which may be evidencing itself in the unit's percentage standing as shown by annual total sales over a period of years. Consequently these seasonal variations are truly applicable to 1923 forecasting; in fact, it would be unwise not to apply them as a correction to the various 1923 annual ratios before using those ratios for the breakdown of monthly sales totals. Further, it is perhaps needless to state that, in view of the cause of these seasonal variations, they may be properly utilized for effecting seasonal correction on both the dead-line and the quota bases.

We have thus completed our analysis so far as it concerns the determination of our 1923 sales dead line and quota; this dual quota plan is seen to extend to the assignment of two figures each month for each unit. Thus, there has evolved a feasible plan which permits the unit sales manager's influence to affect his annual quota assignment, and in addition, provides that the four quota ideals described in our introduction may find effective expression in neither one nor the other of the two monthly assignments we call the sales dead line and the sales quota.

SALES PERFORMANCE RECORD FOR MAY, 1923

Division	May				Year to Date			
	Per Cent of Year's Quota		Per Cent Attained		Per Cent of Year's Quota		Per Cent Attained	
	Assigned	Attained	Dead Line	Quota	Assigned	Attained	Dead Line	Quota
Grand Total . .	8.6	8.2	105	96	39.7	40.1	111	101
Eastern Division	8.8	8.8	108	100	38.6	40.5	113	105
Western Division	8.0	7.8	102	98	42.6	46.8	114	110
Internat'l Co. . .	8.0	6.8	97	85	37.0	34.2	107	93
Total Branch . . .	9.0	8.6	108	96	38.8	37.0	108	95
Boston	9.0	9.0	106	100	38.7	40.3	112	105
New York	9.0	9.4	127	105	38.7	33.2	103	85
Chicago	9.0	7.6	101	85	39.0	34.8	105	90
Seattle	9.0	8.2	103	92	38.7	38.7	113	100
Philadelphia . .	9.0	8.8	105	98	38.7	36.8	103	95
Portland . .	9.0	8.1	99	90	39.2	41.2	116	105

It will be recalled that our discussion first considered, though briefly, the nonetheless important fundamental ideals conceived to be worthy of incorporation in our effective quota plan; then it developed the particular statistical methods of analysis employed as a tool to aid in giving expression to those ideals. Now in closing, just a word or two will suffice to outline the methods employed in the initial presentation of the plan to the sales personnel, and to suggest how current interest is maintained through the aid of our bulletin chart, published monthly, in our sales house organ.

The fact that this discussion has so emphasized the statistical phase of our quota setting must not imply that the human element is overlooked or neglected. Quite the contrary, the discussion has proceeded on the assumption that such careful analysis for forecasting and for control of sales (and of production) will prove of value because the organization has previously labored through the earlier stages of modern industrial and merchandising development, and because such further refinement, following the earlier fundamental development, is the next logical step to assure most efficient utilization of the existing organization, from the local works to the remotest markets demanding our product. Upon the further assumption that the only logical policy for present-day management is to keep all the co-workers informed as to all the facts all the time, a tabulation will serve to show how this is done.

1. Full circulation of the research findings pertaining to sales habits and tendencies, in all the detail here presented, and more, to every unit manager.
2. Newsy write-ups, describing the main purposes and features of the quota setting, appearing in the sales house organ's monthly issues just prior to, and following, the introductory period.
3. A sales managers' conference held at the central office for consideration of many interesting matters, yet with one full session given over to presentation of the quota plan and to arousing enthusiasm for it.
4. Salesmen's conferences at the local units, where individual managers imbue the salesmen with their own enthusiasm for the plan, and where the individual salesmen learn from their managers what measure of effort is expected of them as their contribution to the whole. At these local conferences, as in the central conference, graphic charts, or lantern slide illustrations of them, aid the executives in presenting the plan.
5. Executive orders, issued to authorize and dignify the adopted plan.

Current interest is maintained in the sales house organ by means of timely write-ups and interesting comments on unusual performances, by tabulation of the current month's results in percentage, and by presentation of the "1923 Sales" chart. Fig. 5 shows how this graphic monthly report appears after fictitious May sales figures have been portrayed. The tabulation aids in indicating the month's interesting sales performances. This chart and the tabulation, as may be realized, are very effective for maintaining current interest in the plan and were received with enthusiasm.

Stressing the Dead Line

A final word will bring out one point of greatest value. The statistical analysis stressed the dead line; it represents a "must" requirement not to be forgotten by the salesman, and percentage comparisons are given on that basis in the tabulation. Nevertheless, in the graphic chart, in that which kindles the more impelling desire, the quota idea predominates. In the chart the quota is the 100 per cent normal expectation—the "can." And in the "Monthly" column there is even the suggestion that special conditions may result in a quota excess of 100 per cent. Little vertical lines are observed to be at varying distances from the 100 per cent quota line, and from the ends of the upper year to date bars—hollow bars representing year-to-date assignments for comparison with the year-to-date actual bars. These little lines are the ever-present reminder that dead lines do exist; that their obvious variance is due to the fact that each unit is "on its own;" that the dead line nearest to zero is no more easily approached than the one nearest the quota mark; that, for them as individual managers, the normal is the quota; and that the dead-line mark is just a mile post on the road to the attainment of the management's "can" expectation.

Practical Methods for Planning Work

III—Building a Swimming Pool in Record Time

By WILLIAM B. FERGUSON

Consulting Engineer

Class Number
658:51 Planning
658.9:725.74 Swimming Pool Construction

IN developing this article a different kind of work has been selected from that which has been the example in the two preceding installments.[1] The largest passenger and mail ship afloat is a far different structure from the largest indoor swimming pool. But inasmuch as planning brought the task of reconditioning the first to a successful ending in record time, so planning established a time record in building the second. Each but emphasizes anew that any very large job subdivides into a number of smaller jobs, each one capable of being planned for effective performance.

Two Groups of Sequences

Before describing the work done on the swimming pool it may not be amiss to restate the two groups of sequences, in doing work, which have been previously given. They are:

1. The proper grouping and sequences for raw materials, shop fabrication, and erection of sub-assemblies.
2. The preferred and resultant sequences of succeeding labor operations, and the probable times to start and finish each part or section.

These principles are universal and will be shown as the starting point in planning a construction job in which time of completion was the essence, just as they were the starting point in the doing of the largest repair job ever undertaken.

When the building of the swimming pool in Madison Square Garden, New York, was conceived early in 1921, by Tex Rickard, there were two problems of engineering and management confronting the engineer and contractor who had charge of the work. The first was how to take care of the winter amusements, such as horse shows, circuses, and boxing bouts; the second was the problem of how to accomplish the designing, engineering, and construction work—a quarter-of-a-million-dollar job—all in the brief time available before the summer season would arrive.

Both of these problems were solved by the Engineer in Charge, J. Franklin Whitman,[2] by careful planning; the first by engineering plans, the second by management plans.

The first problem was surmounted by introducing many convertible features into the construction of the tank, so that it could serve the dual purpose of swimming pool and sports arena. Prominent among those features are several bulkheads, the two largest ones being placed at each end of the diving channel or deep diving pool, so arranged that this part of the structure can be converted into a tunnel and thus allow the empty pool to be used as an arena for other amusements.

FIG. 22. STERILIZERS AND FILTERS USED IN THE OPERATION OF THE POOL

The second problem, one of management and the one with which we are most concerned, was solved by foresight and planning down to every detail, and subletting the various classes of work to responsible contractors; then by co-ordinating all their efforts toward a definite objective—to finish all parts complete by certain specified dates.

The record time of 39 *working days* of actual construction work shows how thoroughly the planning was carried out.

The pool is unique not only for its immense size, but also for the many accessory features and the sanitary equipment. The main dimensions are 250 ft. by 110 ft. with a depth of $2\frac{1}{2}$ to 3 ft. at both ends, sloping down to $5\frac{1}{2}$ ft. in the middle, where there is a deep diving section, $15\frac{1}{2}$ ft. deep and 26 ft. wide, which runs across the entire width of the pool. This section is roped off by life lines kept on the surface

[1] MANAGEMENT ENGINEERING, May 1923, p. 293; June 1923, p. 369.

[2] Now President of the Natatorium Construction Company.

of the water by cork floats. As an added precaution for the safety of the divers and bathers, the edges where the drop into the channel is made, are outlined and clearly discernible by a vivid blue streak 12 inches wide painted on the bottom bordering the deep water.

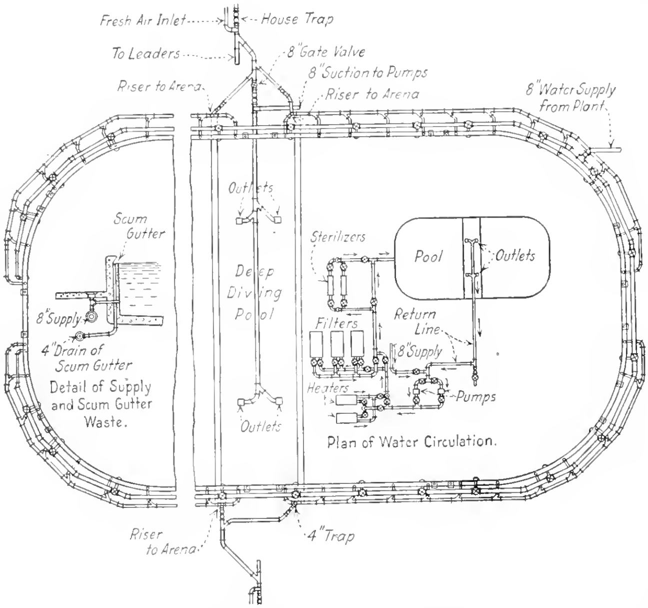


FIG. 23. PLAN OF THE MADISON SQUARE GARDEN SWIMMING POOL, SHOWING THE LAYOUT OF THE SUPPLY AND DRAINAGE PIPING AND INDICATING THE RELATIVE POSITION OF PUMPS, HEATERS, FILTERS AND STERILIZERS

The capacity of the pool is 1,500,000 gallons of water. At the eastern end of the tank is a cascade and waterfall 25 ft. high, an unusual feature in structures like this, adding greatly to the sporting and outdoor effect of the natatorium.

The waterfall is supplied by circulating the waterfall from the pool, operated by pumps and returned through an 8 in. line to the top of the spillway structure. It is estimated that 100,000 gallons of water fall on this spillway every hour.

Unique Features of the Pool

Diving platforms of different heights with springboards are provided and located at each end of the diving channels.

The tank is large enough to accommodate 4000 people at one time, with smoking galleries capable of seating thousands of spectators who view the diving contests and other aquatic events which are held from time to time.

Shower baths are provided for the accommodation of the bathers before entering the pool.

City water is used to fill the pool through the medium of three mains, one 8-in. and two 4-in. These mains are branched together, feeding the water to the purification plant (see Fig. 22) and then encircling the pool as shown in the plan view, Fig. 23. This main is of black steel pipe, with cast-steel fittings. There are 30 branches taken off with 8 × 2½ in. tees set upright with 2½ in. angle valve control, and passing through the pool wall about 6 in. from the bottom, as shown in detail in the drawing in Fig. 23, with 1¼ in. brass orifice. This supply line is capable of supplying 4000 gallons of water per min. and filling the pool in about 6½ hr.

The 8 in. main after consideration was installed to augment the flow and to save time in refilling, as the pool is emptied for cleaning purposes every week and refilled with fresh water, after the sides and bottom have been thoroughly scrubbed and cleaned. It takes 10 hr. to empty the pool. The operation of emptying a tank of such dimensions, unless proper safeguards are taken, might result in injury to the street sewer from the shock or force of such a large volume of water.

To offset any such possible danger, the connection with the street main is made with an obtuse angle along the direction of flow.

On one side of the pool there is a spraying system consisting of ten spray heads set into the wall at the water level. The water supply to these heads is fed by 2½ in. supply branches running through the walls.

Men	Calendar Days	Sub – Contract
100	5	Excavating
70	24	Concrete Work
10	14	Waterproofing
15	40	Painting
15	40	Plumbing and Piping
20	24	Tile
12	15	Reinforcing Steel
15	56	Decorator
18	16	Marbleloid
8	20	Bulkhead Doors
15	30	a. Filters b Pumps c. Sterilizers d. Heaters
8	30	Carpentry Work (forms, steps, etc.)
6	49	Electrical Work

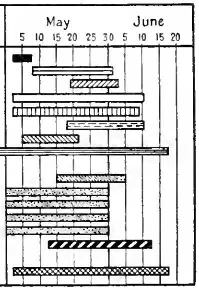


FIG. 24. PROGRESS CHART SHOWING A MINIMUM OF DELAY OR INTERFERENCE BETWEEN THE VARIOUS TYPES OF WORK

The purpose of these spray heads is to send fanlike streams of water across the surface of the pool and to wash scum and floating matter into the opposite scum gutter.

Lint and other suspended matter in the water are removed by a vacuum system, electrically operated, with the piping outlet in the sides of the pool walls midway between floor and water surface. Special traps with fine screen partitions are placed in the suction lines of this system where they can readily be cleaned several times each day.

FIG. 25. ON MAY 2, 1922, A BOXING BOUT TOOK PLACE AT THE GARDEN UP TO MIDNIGHT. THE ARENA WAS THEN CLEARED OF CHAIRS AND RING. THE GUARD RAILS AND DECORATIONS WERE ALSO REMOVED

There is a promenade about 6 ft. wide between the pool wall and the spectators' gallery, with large runways and outlets running from the dressing lockers and shower baths. These are constantly occupied by the many bathers passing to and fro, who deposit a large quantity of water from their dripping bathing suits on the floor and steps. This water is taken care of by 26 3 in. brass floor drains set at equal distances around the pool, connecting into a 2 in. cast-iron pipe which also removes the waste water from the scum gutter. This water is then carried into a 4 in. cast-iron line and branched into the main drain on the sewer side of the 8 in. emptying valve.

All these outlets taking care of the miscellaneous waste water around the pool are trapped and installed at the proper angles for easy flow. As will be seen on the plan view, one side of the structure's drainage empties into the main sewer while the opposite side has a 5 in. drain taking care of its quota of waste water emptying into the street sewer on the opposite side. The necessity for having the miscellaneous drainage separated from and by-passed from the main drainage outlet, is that the pool is operated under what is called the re-circulating system; that is, the water in the tank is constantly circulated through the filters and sterilizers and back to the pool again.

The building of this mammoth pool, as stated before, presented many perplexing engineering problems for the contractors. The tank itself is of reinforced concrete with a foundation of 10 in. walls. The floor and side walls of the deep section are finished and surfaced in concrete. The remaining side walls are

FIG. 26. ON MAY 3 AT 7:00 A.M. EXCAVATORS WITH HORSE DRAWN SCOOPS, PICKS, SHOVELS, LABOR AND TRUCKS BEGAN TO CLEAR AWAY THE TANBARK WHICH WAS LEFT FROM THE CIRCUS. AT 9:00 A.M. THE [illegible] SHOT THE LINES, TOOK ELEVATIONS AND MADE THE SURVEY. THE DECORATIONS WERE STARTED (SEE FRIEZE AROUND BOX FRONT) AND SOME OF THEM ARE IN PLACE [illegible] RIGHT OF PICTURE

tiled and topped off with a special non-slip ceramic tile for purposes of safety.

A Minimum of Delay

The piping used in the heating and plumbing systems, weighing about 180,000 pounds, or representing three car loads, was all delivered before construction work actually started. Each of the 15 or more distinct classes of work was so planned that there would be a minimum of delay or interference as the jobs progressed, the labor operations being shown graphically in Fig. 24.

The progress of work under the plans formulated is best shown by the series of progressive views, Figs. 25-32. Each has a brief description of the work accomplished or underway at the date when the phototype was taken.

Between the date on which the contract was signed, February 5, 1921, and May 3, 1921, when excavating work began, the detail engineering work was completed, estimates made and sub-contracts let for all the classes of work, materials all purchased, and preparations made for starting work at the first opportunity offered after the winter amusement schedule was concluded, which turned out to be midnight May 2.

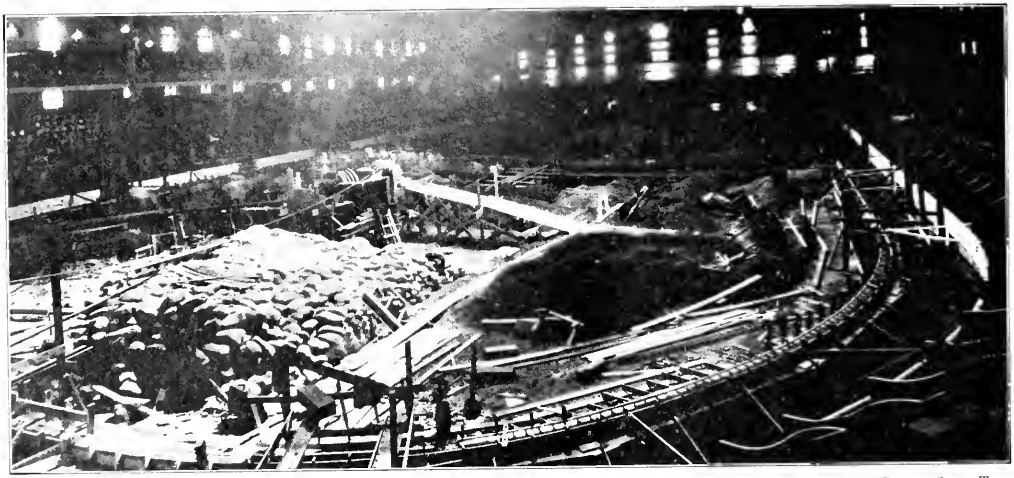


FIG. 27. ON MAY 21 FORMS FOR THE RETAINING WALLS WERE COMPLETE AND THE POURING OF CONCRETE WAS GOING ON. THE PLUMBING WAS COMPLETE. THE DEEP DIVING POOL HAD BEEN EXCAVATED AND FORMS WERE BEING PLACED

FIG. 28. ON MAY 28 THE RETAINING WALL HAD BEEN POURED AND STRIPPED OF THE FORMS; BULKHEAD DOORS HAD BEEN PUT IN PLACE. TILE WAS BEING SET ON THE RETAINING WALL. MARBLEOID FLOORING FOR THE PROMENADE DECK HAD BEEN COMPLETED. FLOOR SLAB OF MASS CONCRETE WAS BEING POURED. ON THE EXTREME LEFT THE MEMBRANE WATERPROOFING WAS BEING APPLIED TO THE SLAB. THE FORMS IN THE DEEP DIVING POOL WERE IN PLACE AND HAD BEEN POURED. THE ENTIRE ARENA FROM CEILING DOWN, INCLUDING ALL CHAIRS AND SEATS, HAD BEEN PAINTED

Fig. 29. On June 7 the Mass Concrete of Floor Slab Had Been Poured [illegible] Waterproofing [illegible] Finished

Fig. 30. On June 11 the Tile Was Finished. The Finished Coat on the Floor Slab Was [illegible]. Electric Work Was Being Put in Place. The Waterfall Was Being B[illegible] Under Way

Here we have before us almost in a motion-picture a notable example of engineering, planning, co-operation of workers, and marvelous accomplishment. The mechanical plant, which includes filters, pumps, sterilizers, and heaters, was all delivered at the building before work was started; the concrete foundations were all poured and ready, and the pumps in place, before the general work on the pool was started. The work on the steel lockers or dressing booths, and the installation of plumbing, drains, etc., in the basement were going on at the same time, as well as the installation of the Roberts filters and the ultra-violet ray sterilizers.

One of the most difficult parts of the undertaking, from a production or management viewpoint, due to the abnormal speed of performance demanded, was the coordinating of the different independent trades or classes of work, which had to dovetail into each other with the least interference, especially the concrete work and the plumbing, etc.

Practical Planning Pays

This accomplishment again illustrates the necessity of practical planning on jobs which have to be performed in a short time and in a building by several different trades. Previous illustrations of such planning were given on the SS. Leviathan, where exactly the same planning principles were involved.

FIG. 31. ON JUNE 18 THE POOL WAS OPENED, HAVING BEEN COMPLETED IN 47 CALENDAR DAYS OR 39 WORKING DAYS

There seems to be no getting away from the historic fact that great records in speed and workmanship on complicated jobs can only be achieved through careful and intelligent planning, thus co-ordinating in a practical way all the time elements of all facts of engineering, design, material control, co-operation of trades, inspection, and incentive.

A time-worn objection to planning which is sometimes raised even by educated, thinking managers is that it takes a large personnel to plan—they fear the bugaboo "overhead." In this particular example, the engineer-manager had only two assistants—one mechanical engineer and one construction engineer.

(To be continued.)

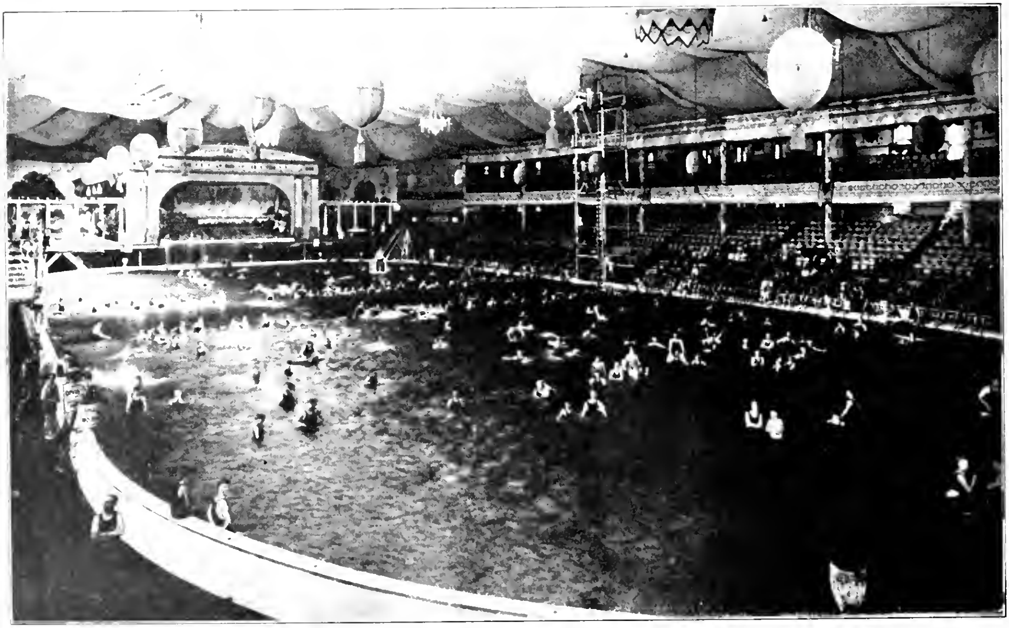


FIG. 32. THIS VIEW SHOWS THE POOL IN OPERATION ON JUNE 19. THE DIVING PLATFORMS OF VARIOUS HEIGHTS ARE BEING USED AND THE WATERFALL IS SEEN AT THE LEFT END

Industrial Government Through Collective Agreements in Germany

By EMIL FRANKEL

Formerly Special Agent, U. S. Department of Labor

THE question whether employers will or will not agree to bargain collectively, and permit their employees to have a voice in determining the conditions under which they are to work, has ceased to be an issue in Germany. With the workers' assumption of political power in the November, 1918, revolution, industrial government through collective agreements has been firmly established in Germany and is bound to stay. Collective bargaining between employers and employees is the sole method of concluding labor contracts in Germany today, and finds application in fields where it was not considered to be feasible before, such as in agriculture or in industries which formerly were strenuous opponents of trade unionism and collective bargaining, including the mining industry, iron and steel industries, chemical and textile industries, etc. Since the revolution, collective bargaining has even found strong adherents among occupational groups such as clerks, salesmen, etc., who were formerly disinclined to enter collective agreements because they considered them to be fetters upon the efficient and ambitious. Collective bargaining is in vogue today among actors, editors, chemists and druggists. The national, state, and municipal authorities, after some hesitancy, have likewise declared themselves very definitely in favor of collective bargaining.

Origin of Collective Bargaining in Germany

The development of collective bargaining in Germany is of somewhat recent origin and is very much like that of other industrial countries, generally the outgrowth of strikes and the desire to avoid unnecessary labor struggles and to bring some law and order into industry. When the workers first began to urge collective agreements upon German employers, they met with universal opposition. With the growth of trade unionism the workers were gradually able to conclude collective agreements, in small scale industries, not because the owners were so anxious for collective bargaining, but simply because they lacked the financial resources effectively to oppose the trade unions. The large-scale industries, such as the iron and steel industries and mining, had been successful in keeping out the collective agreement until the revolution broke in upon them.

Among the workers themselves, opinion was divided at first as to the desirability of entering formal and binding contracts with the employers. Most workers opposed it, because they feared that such agreement would prevent them from making demands on the employer at a time when the employment situation was rather auspicious for making such a move. Among the workers' organizations, the democratic (*Hirsch-Duncker*) trade union at its foundation in 1868 urged the making of collective agreements. The Christian trade unions likewise from the very beginning favored collective agreements. Only the free (socialist) trade unions had to go through heavy internal fights before they definitely became adherents of the collective agreement idea. Collective agreements at first were strenuously opposed by the more radical workers, the principal adherents of the "class struggle" who saw in the collective agreement an undesirable harmony between capital and labor, which they thought must be fought for political reasons as well as for agitational purposes. Costly strikes, fought year after year for the same objects, convinced even the most rabid opponents among the workers as to the desirability of a more sensible adjustment of labor conditions. This conviction found its expression at the 1899 Free Trade Union Congress which definitely declared itself in favor of collective agreements, especially in industries in which there are strong organizations of employers as well as workers, thus making possible a guaranty that the conditions agreed upon will be observed.

The printers constituted one of the earliest unions to suggest contractual regulation of labor conditions, and the first to enter a collective agreement on a national scale (1873). In the late nineties, other industries followed, and the number of collective agreements concluded increased to the extent in which trade unions grew and gained in power. Under the pressure of the war, the reactionary imperial government, which had hitherto strenuously opposed trade unionism and looked askance at collective agreements, began to curry favor with the labor organizations and even went so far as to urge collective bargaining upon reluctant employers.

Revolution and the 1918 Agreement

The revolution, in which the workers played the dominant rôle, naturally gave a tremendous impetus to collective bargaining. Besides, the agreement signed on November 15, 1918, between the big employers' and employees' organizations, in which trade unions for the first time were acknowledged to be the competent representatives of the workers, and which expressly stipulates that the working conditions of all workers should be determined through collective agreements, proved to be of the utmost importance to the future development of collective bargaining.

Collective agreements are designated as written contracts for the regulation of working conditions entered into between a workers' organization and an individual employer or an employers' organization. While an individual employer is authorized to sign an agreement on the employers' side, it must be a labor organization on the employees' side. It was stipulated likewise that only bona fide employees' organizations can enter a collective agreement, which had the purpose of excluding the so-called "yellow" (company) unions, receiving financial and moral support from the employer, from entering into agreements.

Legal Standing and Basic Principles

Until the revolution, collective agreements had no legal standing and rested solely upon the strength of the social forces. The first republican (socialist) government which intended to make the collective agreement the dominant basis for regulating working conditions, in order to create unified labor relations, soon after the revolution issued a decree [1] which regulated the general legal position of collective agreements and established two important basic principles:

1. Forbidding deviations from the norm, disadvantageous to the worker, the so-called *Unabdingbarkeit*, which means that the agreement entered into between the contracting parties cannot be altered through separate agreements, stipulating conditions less favorable than those agreed upon. From the workers' standpoint, the conditions agreed upon are minima, which do not exclude, however, changes in favor of the more skilled or efficient.[2]
2. The extension of collective agreement upon non-contractual parties, which means that if collective agreements have become of predominent importance in the regulation of the working conditions in an industry within the territory covered by an agreement, the National Labor Administration (*Reichsarbeitsverwaltung*) may declare such an agreement as generally binding, signifying that the agreement is applicable not only to workers and employers who had entered into the agreement but also to the employers and workers in the same industry in a given territory who did not become parties to the agreement.

A collective agreement may be declared generally binding upon the request of one or both of the contracting parties, or upon the request of an employers' or employees' organization, which is desirous of being affected by such an extension. The request to extend the sphere of application of the collective agreement is published in the official gazette (*Reichsanzeiger*) and a period specified during which objections must be filed. The National Labor Administration, after careful investigation of the question as to how far the collective agreement has preponderating importance, makes the final decision. Collective agreements made generally applicable, are entered in public registers, thereby serving notice, as it were, upon parties who are likely to be affected by the legal extension.

Extension of Territorial Validity

In line with the industrial concentration process which has created nation-wide employers' as well as workers' organizations, there is also to be observed a tendency to extend the territorial validity of the collective agreement. The collective agreements which formerly would apply only to smaller districts, have gradually been extended to apply to one or more provinces, then states, and finally to the whole of Germany. General agreements, the validity of which extends over larger territories, are concluded in the form of basic agreements (*Mantel or Rahmentarif*) in which only the more general working conditions are stipulated, while the fixing of details, especially the determination of wage rates, is left to supplementary local agreements between individual firms and workers' organizations.

The following table vividly demonstrates the enormous growth of collective agreements in Germany:

DEVELOPMENT OF COLLECTIVE AGREEMENTS IN GERMANY, 1912-1921

End of	Collective Agreements		
	Number	Establishments Covered	Persons Covered
1912	10,739	159,930	1,574,285
1913	10,885	143,088	1,398,597
1914	10,840	143,650	1,395,723
1915	10,171	121,697	943,442
1916	9,435	104,179	740,074
1917	8,854	91,313	905,670
1918	7,819	107,503	1,127,690
1919	11,009	272,251	5,986,475
1920	11,624	434,504	9,561,323
1921	11,488	697,476	12,882,874

Of the nearly thirteen million workers reported covered by collective agreements in 1921 more than two-and-a-half million were women. The headway which collective bargaining has made among salaried employees may be seen from the 1921 figures, which show nearly two million salaried employees under collective agreements, as against 932,000 the year before. It is estimated that there are more than 17,500,000 workers and salaried employees covered by collective agreements today, which comes pretty near including Germany's entire number of the gainfully employed.

In the table that follows, the extent of collective agreements in the various industry groups is shown.

The predominant position of the metal working and machinery industry in regard to collective agreements is very apparent. Next in importance with respect to the number working under collective agree-

[1] *Verordnung über Tarifverträge (Arbeiter—und Angestellten—Ausschüsse) und Schlichtung von Arbeitsstreitigkeiten. Dez. 23, 1918.*

[2] The law permits deviations from the norm in case of persons whose working capacity has been impaired through injury or old age. The works' councils usually participate in the fixing of wages for such persons to prevent their becoming the object of exploitation on the part of the employer.

DISTRIBUTION OF COLLECTIVE AGREEMENTS IN GERMANY, BY INDUSTRY GROUPS, 1921

Industry Group	Collective Agreements		
	Number	Establishments Covered	Persons Covered
Agriculture, gardening, etc	511	119,467	1,643,780
Mining, smelting, salt works, etc	194	3,809	1,562,667
Industry of stones and earths	678	8,179	337,260
Metalworking and machinery	1,430	46,533	2,601,222
Chemical industry	103	12,654	401,235
Forestral by-products	100	515	24,338
Textile industry	440	16,586	909,641
Paper industry	129	18,296	224,867
Leather industry	240	9,398	118,201
Wood working	470	28,486	360,725
Food, beverages, and tobacco	1,693	79,502	517,426
Clothing	920	51,845	408,929
Cleaning	247	1,094	27,740
Building	1,242	71,556	636,256
Printing, etc	48	23,100	125,021
Artcrafts	10	555	2,871
Commerce	1,134	69,798	563,940
Insurance	11	480	86,764
Transport	656	21,192	1,005,644
Hotels, restaurants, etc	116	15,207	121,849
Musical and theatrical estab	115	6,081	45,297
Miscellaneous	1,001	62,843	1,157,201
Total	11,488	697,476	12,882,874

ments, are agricultural undertakings, followed by the mining industry. The collective agreements for the Rhenish-Westphalian coal fields alone cover nearly 600,000 workers. The majority of the workers listed under the transport and miscellaneous groups are public employees; the steam railroads have nearly 600,000 covered by collective agreements; the street railways approximately 130,000. The conditions of employment for more than 300,000 employees of the administrative offices of the national, state and municipal governments are likewise regulated through collective agreements.

Few Agreements Now Concluded by Single Firms

It has already been mentioned that in the last two years there has taken place a notable change in the territorial extent of the validity of collective agreement. The same may be observed with respect to the signatory parties. There are very few agreements concluded today by individual firms. Agreements by large employers' and workers' federations having validity over extensive territories are fast becoming the rule. In 1922 collective agreements covering nearly 85 per cent of the total number of persons employed were concluded between workers' and employers' organizations. Nearly 70 per cent of the persons covered by collective agreements were subject to wage agreements valid for an entire district, while practically 20 per cent were covered by national agreements.

The extent to which voluntary collective agreements are "legalized" may be seen by the large number of collective agreements declared generally binding. In December 1922, 586 local, 1073 district, and 79 national agreements were made generally applicable. Due to the unstable industrial conditions, the duration of the validity of collective agreements, which was generally three years before the war, is comparatively short today usually from one half to one year, frequently much less.

Subjects Covered by Agreements

Collective agreements, which long ago ceased to be mere wage agreements, today cover a great variety of subjects and often regulate working conditions in the minutest details. A few of the more important subjects covered by collective agreements are these:

Wages. In the collective agreements in force in 1921, the form of wages paid was definitely stipulated for more than 12,500,000 workers, of which number about 30 per cent received time rates exclusively while more than 60 per cent received both time and piece rates. The number receiving piece rates only is insignificant. Provisions guaranteeing minimum earnings to piece workers are contained in agreements covering more than six million workers. The return to piece-work in German industry is significant. Immediately after the revolution, the workers universally demanded the abolition of piece-work, in which they saw a most offensive form of exploitation (*Akkord-Arbeit ist Mord-Arbeit*). They succeeded at that time to a considerable extent in abolishing piece-work. Inexorable economic conditions caused them to give up their opposition. Gradually piece-work has been restored, with certain safeguards thrown around it through collective agreements. Piece-work wages are generally fixed by a special piece-work commission of the shop or by the works' councils, a function which they have been given under the works' council law.

A characteristic development in Germany is the leveling of the wages of skilled and unskilled. Before the war, the wages of skilled workers were nearly 50 per cent higher than those of the unskilled. Today the difference is less than 10 per cent. The same leveling tendencies in regard to wages may be observed among the various grades of salaried employees, and reach even the highest officials. A collective agreement which regulates wages for a larger territory, a province, or the whole of Germany, usually divides the various localities that are embraced by it into certain classes dependent upon the prevailing cost of living.

Special Grants for Married Workers

Interesting is the development of the so-called social or family wage, which means special wage grants to married workers; the addition to ordinary wages generally amounting to from 5 to 15 per cent for the wife and from 2 to 5 per cent for each child. Opinion is divided in Germany as to the desirability of this method of wage payment. The employers' organizations generally advocate it because under the present impoverishment of Germany they say an unmarried worker should receive lower wages than a married one. The trade unions outside of the free trade unions favor family wages. The free trade unions sharply oppose it because they fear discharge of the married workers and the possibility of weakening the feeling of solidarity among their members. They want the payment of equal wages, but advocate the increase of the wages of married workers indirectly through tax exemptions, education grants, school feeding, etc.

The social wage, nevertheless, is widespread in Germany. It is in vogue in all national, state, and communal offices and enterprises, in the entire mining industry, and to a large extent in other industries. A number of industries have worked out an interesting scheme under which the family wages are not borne by the individual employer but by a common fund, to which all employers contribute in proportion to the total number employed, figures including both married and unmarried. By this wage fund method, it is claimed that the incentive of the employer to employ unmarried workers only is at once taken away.

Hours, Vacations, and Contract Terminations

Hours of Labor. The collective agreements in force in 1921, which regulated the weekly working hours, showed that about 65 per cent of all persons covered worked 48 hours per week; nearly 30 per cent worked less than 46 hours. The corresponding percentages for women were 55 and 40 per cent. The shorter-than-48-hour work-week is found principally in the textile, metal working, and mining industries. The recently observed tendency of a considerable number of workers to accept additional employment for wages in their spare time, has been met in collective agreements, generally by forbidding such extra work and also by considering it to be sufficient ground for discharge.

Vacations. While before the war collective agreements which contained provisions for vacations were the exception, they have become the rule today. Collective agreements for more than 86 per cent of the persons covered contain regulations regarding vacation time. Duration of the vacation, which usually depends upon length of service or age, was up to three work days for 50 per cent of the employed, over three to six days for more than 40 per cent, and more than six work days for 10 per cent of the total number embraced by collective agreements.

Termination of the Labor Contract. An important proviso in the collective agreements is the giving of notice to terminate the employment contract. Such provisions were made for nearly five million workers, notice in the majority of cases being from one to two weeks, but a considerable number stipulating more than two weeks.

Conciliation and Arbitration. Machinery for these purposes is provided for in most of the agreements. On the conciliation boards employers and employees are represented in equal numbers. The boards are usually presided over by an impartial chairman selected by the board itself, or one appointed by the ministry of labor.

Employment Offices. The use of specified employment offices is stipulated in collective agreements covering more than four and one-half million workers. In most cases these offices are administrated jointly by the employees and employers, their use being obligatory upon both parties.

Present Attitude of Employers and Workers

The employers of Germany have by now generally accepted the collective agreement idea, for in times of constant economic flux such as Germany is experiencing they have begun to see the necessity for a unified regulation of labor conditions, covering at once as large a number of workers as possible. They realize that it would create industrial chaos to attempt to substitute hundreds of thousands of individual labor contracts for the present collective regulation. They are aware that the economic benefits which the employer generally derives from collective bargaining, such as industrial peace, certainty of knowing manufacturing costs, elimination of unfair competition, etc., cannot play such an important rôle under the present demoralized industrial situation.

The workers, as a whole, even the radical communists, today consider the collective agreement as a desirable instrument for the regulation of labor conditions. Collective agreements have proved to the workers that the bargaining weakness of the individual worker can be overcome only by his organization, which alone is capable of coping with the infinitely greater bargaining strength of the employer. The collective agreement protects the worker from one-sided dictation of labor terms and offers a means by which he can resist the pressure of unfavorable economic conditions. The collective agreement has further been proved elastic enough to be more than a mere instrument for the regulation of wages. It has come to have the aspect of an extra legal code or industrial law which has proved a fruitful source of labor legislation in the new Germany.

Outlook for the Future

It is not too much to say that collective agreement will remain for a long time to come the determining form in which the regulation of labor conditions will proceed in Germany. It is quite likely that future fights for enlarged labor rights and democratization of the industrial process will be carried on within the frame of the collective agreement. While efforts for enlargement of the workers' rights must necessarily be pushed into the background today, because all the energies of the trade unions are concentrated on securing wage advances to meet the ever-mounting cost of living, it is quite likely that they will take up the fight tomorrow; that is, when stabilization of the currency will enable the trade unions to direct their efforts, now fruitlessly expended in wage fights, toward securing a determining voice in labor adjustment and in industrial management, things they are determined to obtain. Due to the peculiar adaptability shown by the collective agreement in meeting changing social and industrial conditions, it may be expected that this process of labor interpenetration will proceed with the collective agreement as a basis, and will advance gradually with a minimum disturbance of orderly economic processes.

Buildings from the Manager's Viewpoint

Practical Suggestions on Fire Protection, Sanitation, and Service Equipment

By G. L. H. ARNOLD

Associate of Frederick A. Waldron

Class Number

658.2 Industrial Buildings
658.28 Service Equipment

An industrial building in the ordinary acceptance of the term includes the permanent equipment: heating; ventilating, if any; plumbing; fire-proofing; elevators; wiring; etc. In the earlier articles of this series, we have discussed the building itself in some detail from the manager's point of view.[1] In this

FIG. 1 A REPRESENTATIVE INDUSTRIAL LABORATORY

concluding installment attention will be called to some phases of the equipment. Such things are apt to be left to the design of the building as being routine matters whose details affect neither production nor the balance sheet and hence have no power to repay a busy manager for any time he might devote to them.

That is a mistaken view. The new building is an expensive machine of great possibilities which, however, cannot "hit on all twelve" all of the time unless all of the accessories are suited to their duties and location. The personnel, which is the cutting tool of the production machine in the new building, must be kept sharp and fit or production will suffer.

Sprinklers

The absolutely fireproof factory is as far off as the perfect man. And even if we could produce it readily, we would still need the automatic sprinkler to protect the contents. There are processes in which water is not only no protection, but is actually a source of danger, and where carbon tetrachloride, foamite, or other special agents must be employed. Such places are exceptional and their danger known and watched over. Even here the sprinkler is used, but with a suitable quenching material in place of water.

There need be no hesitation to use sprinklers on account of the danger of unnecessary water damage. Surely it would be hard to find a place where the hesitation on that score would be more than in the great city dry-goods and department stores; and they are all sprinklered.

Besides the building, the fixtures, and the stock, there is in an industrial building another element to be protected—the people employed. Many of the leading men among the insurance companies handling casualty and compensation risks are saying they believe that the installation of automatic sprinklers should be compulsory in every building where people congregate.

Fire Escapes

The open, out-of-doors fire escape may comply with the law, but it is a poor substitute for a safe emergency

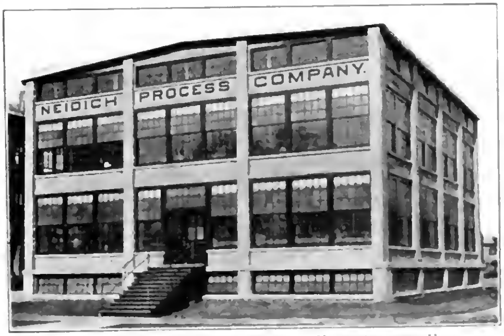


FIG. 2 THIS BUILDING WILL BE FIVE STORIES HIGH
The Temporary Half Story Was Obtained at Slight Expense

exit. Its unaccustomed proportions, its slightness of structure, and its awkward location make it a hazardous route at best, while smoke, ice, wind, or darkness may make it still less suited for use by excited people in haste. Most fire escapes fortunately are never called into service, but there is always the possibility that ours will be the one needed. For the safety and comfort

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[1] See MANAGEMENT ENGINEERING, February 1923, p. 101, "To Build or Not to Build," by Frederick A. Waldron.

Ibid., March 1923, p. 177, "Buildings from the Manager's Viewpoint—Types of Industrial Construction," by G. L. H. Arnold.

Ibid., April 1923, p. 229, "Planning Entrances, Stairways and Windows for Convenience and Safety," by G. L. H. Arnold.

Ibid., May 1923, p. 329, "Foundations, Floors, and Ceilings for the Well-Planned Factory," by G. L. H. Arnold.

Ibid., June 1923, p. 417, "Planning the Roof, Partitions, Doors, and Equipment," by G. L. H. Arnold.

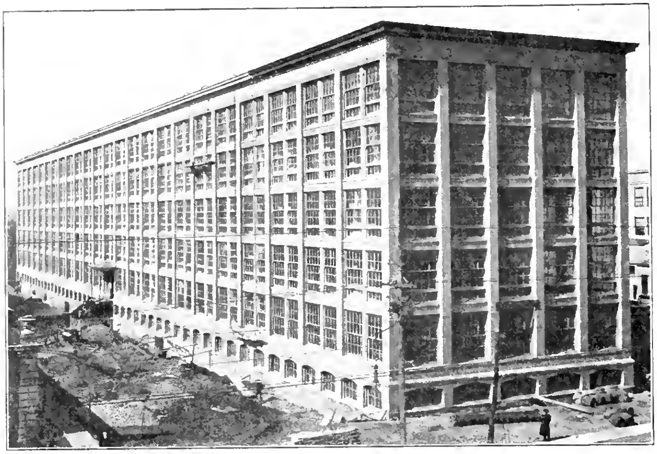


FIG. 3 A GOOD EXAMPLE OF AN INDUSTRIAL BUILDING

of all concerned it would be far better to provide ample stairways in proper enclosures as already discussed and avoid any cause for possible regrets.

Conveniences for Employees

The obligation to assist a fellow man in maintaining his self-respect, and the advantage to the employer from the better care of the human machine, both of which are today universally recognized, combine to make attractive and sanitary wash- and locker-rooms a matter of course. To facilitate and encourage personal cleanliness, the washroom should have an abundance of light and air with ample individual washing facilities. The materials used should be such as to make it temptingly easy to keep the entire place clean and sanitary.

The lockers should give to each man a sense of security enabling him to go to his work feeling that his clothes are safe from thieves and practical jokers and free from contact with those of anyone else. Undivided attention to one's work is absolutely essential to efficiency, but is not compatible with doubt as to the security of one's clothes.

Much annoyance, inconvenience, and the possibility—even probability—of accident may be avoided by taking care to arrange the wash- and locker-rooms in relation to the exits so as to avoid conflicting currents during the rush of traffic when the force is entering or leaving. As the arrangement which produces least interference also gives the most rapid handling of traffic, the saving in time will repay the time and thought expended on this problem.

The location, ventilation, and sanitation of the toilets have a much greater influence on the health and energy of the force than is generally suspected. The manager who hopes to get the best results will see that fixtures and materials are of the best, that the piping and venting are correctly installed, that the toilet-rooms are of ample capacity, conveniently placed, and with abundance of ventilation and daylight. Also, they must be kept scrupulously clean. The camouflaging of unwholesome conditions by the use of counter odorizon will not remove uncleanliness nor prevent its objectionable results.

The first cost of the installation may be reduced by marshaling the entire equipment about one stack, but the apparent gain will in reality be a loss. The longer trip takes more of the operatives' time, encourages visiting and the wasting of time, frequently causing neglect on the part of the supposedly busy operative with consequent loss to his efficiency. All of these losses are constantly recurring while the increased cost of installation would have occurred but once.

The so-called restroom which is a necessary provision for women employees need not be—in fact, usually is not—a source of loss. If the number of women is great enough to warrant placing the restroom in charge of a level-headed nurse who is not too sympathetic, it will be found to have an appreciable influence toward efficiency.

Drinking Water

A circulating system of refrigerated, filtered, drinking water with conveniently distributed drinking fountains is possibly not a necessity, but it is something no

FIG. 4 EXPENSIVE MACHINERY BUT SCANT LIGHT AND VENTILATION
Rapid and Accurate Work Is Impossible in Such Surroundings

manager would voluntarily do without. All other means of supplying the drinking water which is so necessary to health have their weak points and are the causes of most of the summer ills, while the cost of icing and caring for coolers may be easily as great as the cost of operating the cold water system.

Freight and Passenger Elevators

In a multi-story factory the elevator problem is quite different from that presented by a commercial office building. In the latter the handling of freight is secondary from the standpoint of quantity, and can usually be concentrated into specified hours, while passengers must be carried throughout the day with the least possible delay. Generally the freight is handled by the passenger elevators during the less busy hours. In the factory, on the other hand, the passenger traffic is mostly confined to four short and crowded periods each day. Some passenger elevator capacity will be needed throughout the day, but the bulk of the capacity will need to be freight cars equipped to handle passengers at starting and quitting time.

In studying the question of elevator needs the question of transport of materials should be considered in its broader aspects because there are so many cases where economies can be effected by the use of conveying apparatus especially suited to the conditions. This subject, which will not be discussed here, is so broad and is so rich in possibilities that no manager of an industrial establishment can afford to rest content without giving it a thorough investigation. Indeed, it is one of the problems which does not stay solved. The wise manager will reopen the subject from time to time in order to profit by new possibilities or changed conditions.

FIG. 5 REAR VIEW OF FIG. 3. SERVICE INSTALLATIONS AND STAIRWAYS ARE IN THE WINGS TO KEEP THE MAIN BUILDING CLEAR AND AVOID CONGESTION OF TRAFFIC

Whatever their type or service, all elevators need to be completely equipped with the most improved safeguards. An elevator by its very nature offers many opportunities for accident. The elevator manufacturers are keenly aware of all of these hazards and have devised efficient safeguards which should be provided and used. There is a lamentable tendency in factories to ignore the dangers and even to disconnect the safety devices. Frequent inspection is needed to insure that no such flirting with danger is practiced.

Dust Removal

Buffing and grinding and similar operations are equipped with dust removal systems as a matter of course, but there are many other operations which are not usually so equipped where it will prove a profitable innovation. The ordinary currents of air carry such dust to considerable distances and let it fall regardless of the nature of the surface on which it may land. Frequently unsuspected opportunities exist to improve working conditions, cost of operation, or quality of work, or even all three of them. Furthermore, all dust from combustible matter becomes explosive when conditions are right and should be removed for safety's sake if for no other. In handling all such dust, care must be exercised to guard against the possibility of sparks caused by heavy particles which may be picked up and borne along to the fan.

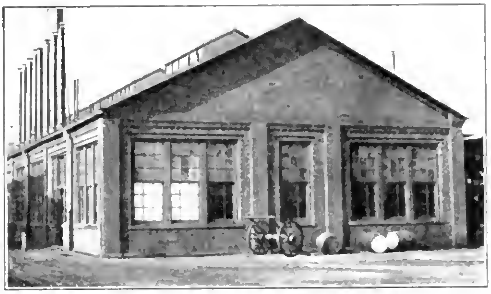


FIG. 6 A JAPANNING DEPARTMENT SHOWING VENTILATING STACKS

Dust-blowers in connection with pneumatic carriers and all other fan systems remove air in large enough quantities to upset the heating and ventilating, unless specially provided for. It may even be necessary to readjust the relation between departments to prevent one exhaust system nullifying the effects of another. Draughts prejudicial to the health of a group of employees are frequently caused by dust carriers whose supply of air was not properly arranged for.

Air Washing and Conditioning

The desirability of having the air free from dust in the varnishing and enameling departments is obvious,

Courtesy of the Turner Construction Co.

FIG. 7 A MODERN INDUSTRIAL WAREHOUSE OF CONCRETE CONSTRUCTION

but it is surprising how many other operations are benefited by the simple process of washing the air. The better the ventilation the greater the need of clean air, for the simple reason that the more air passing through a room the more dust goes through with it, and naturally the more dust stays where it should not be; just as when you try to wash a floor with dirty water, the more dirty water you use the less clean the floor gets.

The moistening of air is another promising field for improvement whose possibilities are too often neglected. A few industries recognize the importance of controlled humidity, but the number is but a small fraction of the whole field. In addition to the benefit to the materials being worked there is a great opportunity to benefit the worker. Heated air is naturally low in humidity and produces excessive dryness throughout the breathing apparatus, making us more susceptible to the effects of drafts and microbes. In many cases, suitable moisture control permits a reduction in the temperature maintained with a resultant saving in the coal bill.

Ventilation

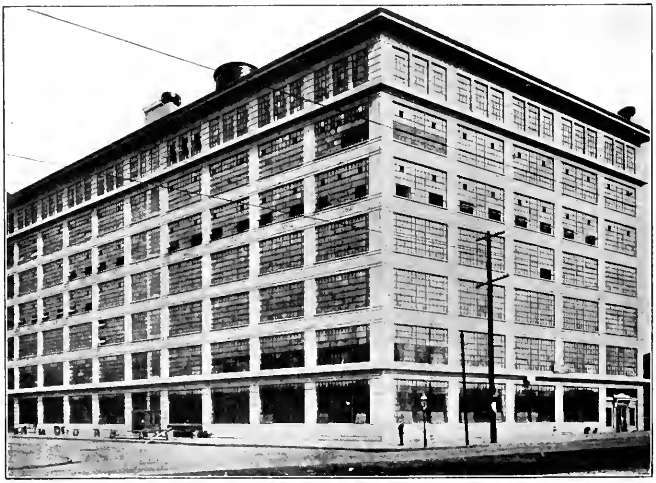
It is difficult to construct a factory building so tight that the leakage will not supply natural ventilation sufficient for some variety of occupancy. On the other hand, crowded areas, the production of gases during the processes, and other special conditions may make the requirement for forced ventilation obvious. The manager will usually find himself in the middle ground where good judgment will be needed to decide whether to depend on the windows or to install blowers.

Heat and Power

Heat, power, and manufacturing steam are required in varying degrees by certain industries. The variations are so great that each plant offers its own problem for individual consideration. When the heat balance is right a power plant may furnish heat, as a by-product, for almost nothing, but that does not justify the assumption that an isolated power plant will be economical under somewhat different conditions. The solution is a matter of calculation based on observations of the existing conditions and is comparatively free from arbitrary assumptions.

Wiring

The construction of a new building offers both opportunity and invitation to provide conduits buried in the structure, for all power and light wires, where they will be out of the way, safe from injury, and yet easy of access for rearrangement or extension. Since the



Courtesy of the Turner Construction Co.

FIG. 8 A WELL-LIGHTED FACTORY IN THE METROPOLITAN DISTRICT conduits once buried are fixed, their arrangement should be thoroughly studied and all possible alterations and extensions considered so as to provide the utmost flexibility with the minimum of expense. There is no occasion to cover the floor with junction boxes, nor, on the contrary, is it necessary to render reasonable changes difficult and expensive.

Present-day methods have rendered possible a speed of construction to suit the most impatient. Of course, extreme speed is expensive. Purchasing from yard stocks regardless of excessive prices or wasteful quantities, delivery by express and special messenger, bonuses for extra speed, reserve men standing idle to fill up gaps instantly, are all essential in a race against time, and they all add enormously to the cost. At the other extreme, hunting bargains with deliveries at seller's convenience and slow freights, economy in labor and equipment, cut down costs but eat up time.

Somewhere between the two extremes is the economical rate. In deciding just where the true speed lies, there are two very important factors, one or both of which are too often forgotten. One is the lost overhead on the new building. Interest and taxes on the lot, and on the amounts already spent, keep on increasing and may easily reach a point where it is cheaper to pay the price for speed. The other is the anticipated profits to accrue from the use of the new building. The sums paid out for the new building are conspicuous while the other two items are not visible until dug out by the accountants, and therefore both are usually underestimated. I would commend them to the manager's attention.

One of the most profitable investments which any manager can make in connection with an industrial building is in grass and shrubbery. No one appreciates a bit of nature more than the person who is confined all day indoors. The eye, although we are seldom conscious of it, is usually the first of our faculties to tire and to reduce our speed. The best and quickest remedy for tired eyes is to gaze on growing verdure.

To insure daylight, and for fire protection, there must be space between buildings. Some of this space will naturally be used for fire hydrant and hose houses and some for roadways, but what is left may, at small expense, be made into an ornament to the plant which will increase its desirability as a place to work, increase the loyalty and good-will of the employees, and make easier the job of the employment department.

The erection of a new building affords a wonderful opportunity to effect lasting improvement in the quality, quantity, and cost of output, also in the welfare and good-will of the employees. To secure the utmost benefit, every detail of the new building, its location, design, construction, and equipment, must be carefully studied to insure that it shall be suited to the occupancy. Before the plans are started there should be a thorough investigation into the existing conditions, present requirements, and probable future needs. The thoroughness with which this is done will determine the possibilities of the new building.

Courtesy of Hamilton Maxwell, Inc.

FIG. 9 THE GREATEST COLLECTION OF INDUSTRIAL BUILDINGS IN THE WORLD, INCLUDING FACTORIES, WORKSHOPS AND MAIN OFFICES REPRESENTATIVE OF MOST OF THE LEADING INDUSTRIES IN THE COUNTRY

Routing Automobiles Through Assembly

Class Number
658.512 Routing
658.9: 629.113 Automobile Plant Management

THE progressive assembly of automobiles has been carried to high development along what is called the conveyor method, according to which an automobile starts at one end of the assembly shop and travels past a series of workmen, each of whom adds a part, until at the other end of the room the machine arrives complete. Instead of a conveyor, trucks may be substituted and the same effect will be secured, provided that the trucks are all kept in as straight a line as if they formed a conveyor, and provided they move forward with periodic frequency.

Assembling the Engines

One automobile assembly room is laid out in definite truck routes which illustrate this method. Down the north side of the room, which is an extension of the engine-manufacturing- and machine-room, the engines travel while being assembled. Workmen stand at their benches along the windows, and the line of trucks bearing the engines, runs along on tracks parallel with the benches and three feet from them.

The rail farthest from the bench is a channel-iron, laid web side down. The other rail is simply a flat strip of steel 4 in. wide to take the wear of the two wheels on the near side of the trucks. A truck, once started along this track with its outer wheels running in the channel, cannot get out of line, but must go forward with the other trucks. Each truck is arranged with its upper part in the form of a cylindrical frame which can be revolved around an axis, so that an engine bed once bolted in place in it can be turned over readily and will remain in place. Since the trucks are standard, and likewise the engines, and the track is at a fixed distance from the bench, the workman soon falls into the habit of standardized motions, which mean efficiency. The separate trucks are better than a conveyor, for they give a certain flexibility of forward movement that is very convenient when a man runs against a particular difficulty.

Chassis Assembled on Opposite Side of Room

The engines on their trucks go down the north side of the room from west to east. At the same time the chassis are going up the south side of the room from east to west; and when they reach the end of the assembly section, they turn again and come down the middle of the floor, at the end of their route meeting the completed engines. Here each engine is put upon its chassis while the latter is still standing on its truck; with the addition of tires, the assembled automobile is ready to go out the east end of the room.

The trucks for handling the chassis are much bigger and longer than those for the engines. They are built in the shop which uses them, and are made of 2 in. wrought iron pipe, assembled with the proper fittings, and with a swivel wheel under each of the four legs.

While going along the south side benches, these trucks travel endwise on a track having 3 ft. between rails. These rails are of the same type as those for the trucks to carry engines. When the chassis have passed the end of the wall bench, each truck must make a quarter turn to get over to the track down the middle of the room. To negotiate this turn the one channel-iron rail is curved in a quarter circle of proper radius and the flat strip rail is broadened out to a width of 18 in. to allow the outer wheels of the truck to slide.

Turning the Chassis Broadwise

When going down the middle of the room a chassis travels no longer endwise but broadwise on, and the rail spacing must be 12 ft. The change from the narrow track to the 12 ft. gage track is made by continuing the narrow track across the room, after it makes the quarter turn, and bringing the ends of the broad gage track up to intersect it at right angles. The truck, while still endwise on the narrow gage track, is stopped with the wheels at the intersection joints; then the two men who handle a truck go around to the rear and push it broadside at right angles to its former direction. The sides of the channel irons are cut away where they fit together, so that each of the swivel wheels under the truck can turn around a sharp radius from one set of tracks into the other at right angles.

Turning the Chassis Upside Down

Most of the small parts are put on from the bench, and on the under parts of the chassis, so that it is convenient to have the chassis bottom-side up while it is moving alongside the bench. But when it is to move down the middle of the room, it should be right-side up, so that the heavier parts can be put on in the proper way. Therefore, each chassis must be turned over at the time when it changes from narrow gage to broad gage track. The turning is done with the aid of two jigs, one of which is clamped quickly to each end of the chassis. Each jig is permanently swung from a hoist running on a short section of trolley track, just over the intersection points of the broad gage and narrow gage tracks, and just above the ends of each chassis when it pauses at this point. When the two jigs have been clamped firmly to the two ends of the chassis, both are hoisted simultaneously until the load is free from the truck. By simply turning a large hand-wheel attached to a central axle which is part of each jig, each chassis is turned over in the bearings of the two jigs without conflicting with the hoist chains. When the chassis is turned through 180 deg., the jigs are lowered until the weight again rests upon the truck. With this arrangement it is possible to turn over 12 chassis an hour, although they are very heavy, and under hand labor would require perhaps an hour apiece.

The Bugbear of Burden Distribution

A Plan to Eliminate Its Work and Worry

By G. CHARTER HARRISON

Consulting Accountant

THE average industrial accountant regards elaborate monthly burden distribution as being in the same category as death and taxes—unpleasant but inevitable. He will cheerfully admit that the making of these distributions is the bugbear of cost accounting, and that if he did not have to make them his cost sheets could be presented days earlier in the month; but he will ask you with a shrug of his shoulders how you are going to get away from this procedure and yet get accurate figures. When one considers that the burden item in the average industry is generally much larger than the whole of what is termed the *producing pay-roll* one has to admit that unless burden is distributed on some fairly scientific basis, cost figures will be unreliable and misleading. It is possible, however, to get away from elaborate monthly burden distributions and still get accurate figures. This article will explain and show how this result can be accomplished.

The Factors in the Problem

Before entering into the details of the method it is necessary to consider the factors entering into the problem. For the purposes of illustration we will consider the very common method of burden distribution by departments. Here records are kept for each operating department showing the direct producing labor, the direct burden items of the department—as the pay of such indirect labor as foremen, shop clerks and truckers—the stores and supplies consumed, and the labor and material cost of repairs. In addition to these items of direct departmental burden there are what may be termed the *distributive burden items* such as, the overhead of the service departments which do repair and maintenance work, power, heat and light, the floor space factor, and the general factory expenses. It is these distributive burden items which present the great difficulty, and incidentally it may be mentioned that it is the distribution of these which renders in many cases the departmental cost sheets objects of scorn, suspicion, and derision in the shop. As the writer once stated:

> The absurdities of the usual methods of burden distribution are most evident when the results obtained are considered from the standpoint of their value to the operating man. Under the wheel-within-wheel methods of burden distribution generally followed, expenses are distributed and redistributed innumerable times, the result being that the final figures presented have no real significance, and only by the most detailed and elaborate analysis can the elements of which any figure is comprised be determined. The elaborate systems of distribution defeat the purpose for which they were introduced—instead of clarifying the situation, the farther they are carried to their logical conclusion the more they befog the issue, so that finally a single figure on the cost statement represents an inextricable conglomeration of more or less irrelevant factors and the figures mean little or nothing to anyone but the man who compiled them, and even to him have little significance unless he first tears down into their component elements the figures which he has so painstakingly built up.

Where such methods of distribution are used is it to be wondered at that the foreman of a department, which shows an increase in the item of repairs, is apt to become blasphemous about the cost system when he discovers that the increase in question is not due to excessive repairs but to an increase in the burden of the machine shop, or that the foreman of the latter department is inclined to use sulphurous language when he learns that the increase in the burden of his department is due to factors over which he has not the remotest control such as, for instance, an increase in the price of coal, in the superintendent's salary, or in the number of watchmen on the pay-roll?

How the Operating Man Views Burden

Considered from the standpoint of the operating man, elaborate distributions of burden are worse than useless, and even if it is desired to bring the indirect burden items into the departmental cost statements, they should always be shown separately. For instance, the cost of repairs should be stated in two sections: first, as regards the cost of the material and labor, and second, as regards the burden charged to the department for the repair work done for it, so that a clear line is drawn between those expenses for which the foreman is directly responsible and those over which he has no control.

What, then, should be the purpose of distributing the indirect burden items? The answer to this question is that it is necessary to distribute these expenses to the operating departments in order to be able to arrive at departmental burden rates—or machine rates when these are used—so that we may obtain correct information as to the cost of manufacturing specific articles and as to the profit and loss realized from their sale. To secure these two items of information is the only logical purpose for distributing the indirect burden items at all. Distribution does not aid in controlling distributive expenses but rather the reverse.

At this point, attention should be drawn to what may be termed the fundamental fallacy of cost accounting, namely, the idea that the same general plan of cost accounting which would be suitable for keeping track of the cost of building a sky-scraper, a Brooklyn Bridge, or a battleship, is also ideal for keeping track of the cost of automobiles turned out by the thousand, or of teaspoons manufactured by the tens of thousands. All so-called "lot" or "order" systems for concerns manufacturing a standardized product, which call for costs of each order or lot, are the result of this unfortunate fallacy; the lack of appreciation of the fact that a system of accounting, which is suitable for a specialized product, is also entirely suitable for a concern manufacturing standardized articles being made over and over again, and is the primary reason for the numerous failures of cost accounting.

As a matter of fact, the writer has never known of a case where a system of cost accounting which endeavored to keep track of the cost of individual orders in a business manufacturing a varied line of standardized articles has ever worked out successfully. Such systems may have worked, it is true, but the cost of operating them has been out of all proportion to the benefits derived. It is hardly an exaggeration to state that such systems give minimum results for maximum effort.

Obviously, it is an absurdity in a business manufacturing the same articles over and over again to endeavor to keep track of the cost of every order passing through the factory. The simple, sensible method of handling such costs is to compile the cost of each article once (this standard cost not being changed unless there is some relatively permanent change in the conditions of manufacture as, for instance, a change in a piece rate or in the character of the operations performed) and to introduce some simple means of keeping track of variations from the standard in total, so that for the purpose of obtaining current costs or cost of sales, the standard costs can be adjusted to the basis of present conditions. These comparisons, of course, afford excellent information as to operating efficiencies, but this particular feature of the subject can only be referred to incidentally in this article. Standard cost systems along the lines just indicated, if properly designed and introduced, will give admirable results with little expense in those situations where the individual order cost system has fallen down hopelessly owing to the immense amount of clerical work involved.

A Principle of Burden Distribution

This same principle of gathering the essential data once and once only can be applied to the problem of burden distribution. Instead of making elaborate burden distributions every month (and in the majority of cases elaborate distributions are absolutely necessary if we are going to get even approximately correct costs) we make a most careful distribution of burden to producing departments *once*, and use these results as a basis for the monthly figures. This practice means that we reduce the matter of distributing direct burden items to one proration a month instead of a hundred or several hundred. This method will give sufficiently correct information for all practical purposes with but a fraction of the work usually required, and will enable the cost statements to be prepared days ahead of what was possible under the elaborate monthly burden distribution plan.

There is something hypnotic about elaborate rituals. After performing them a number of times the devotee is apt to discard any critical faculties he may have originally possessed in favor of a blind faith, and this applies with considerable force to burden distributions. After a time the mental attitude of the man performing these operations becomes such that it is almost a heresy to suggest that anything but the most accurate information can result from all that wonderful figuring, but nevertheless, the candid cost accountant must admit that under any circumstances a great deal of burden distribution must inevitably be more or less arbitrary.

The Bunk of Absolute Accuracy

Take, for instance, the elaborate distributions of power which are so religiously undertaken every month in thousands of factories the world over. How often does an accountant get really accurate figures of power consumption on which to base his distributions? It is generally largely a matter of an intelligent guess, and unless there are meters in every department, this must necessarily be so, and the writer has never yet come across a factory where there are meters in every department. Under these conditions the cost accountant must admit that his power distribution figures are largely bunk, considered from the standpoint of accuracy.

The same criticism applies with even greater force to those items of general expense between which and any particular production unit there is little direct connection. Take the salary of the superintendent. Can anyone claim that there is any really logical method of distributing this expense to the individual producing departments? The fact remains that there is no such thing as an absolutely accurate cost of manufacturing anything, and even if an accurate cost could be figured today it would be incorrect tomorrow.

Useless Calculations

Let us consider the matter from another angle—perhaps the most important of all—and that is whether any concern has ever saved a solitary nickel as a result of very fine distributions of items of general expense. One thing is certain, however, which is that a vast amount of money has been and is being expended in the making of these elaborate distributions, but what has been realized as an offset to this expense? Does not the manufacturer sometimes wonder when he hears the merry clatter of the calculating machines in the early part of each month whether all of this activity is not a mere beating of the air?

It is obvious that to obtain even approximately accurate costs (and we may rest assured that in a complex business we can never hope to obtain other than approximate accuracy) we must allow for the necessary and

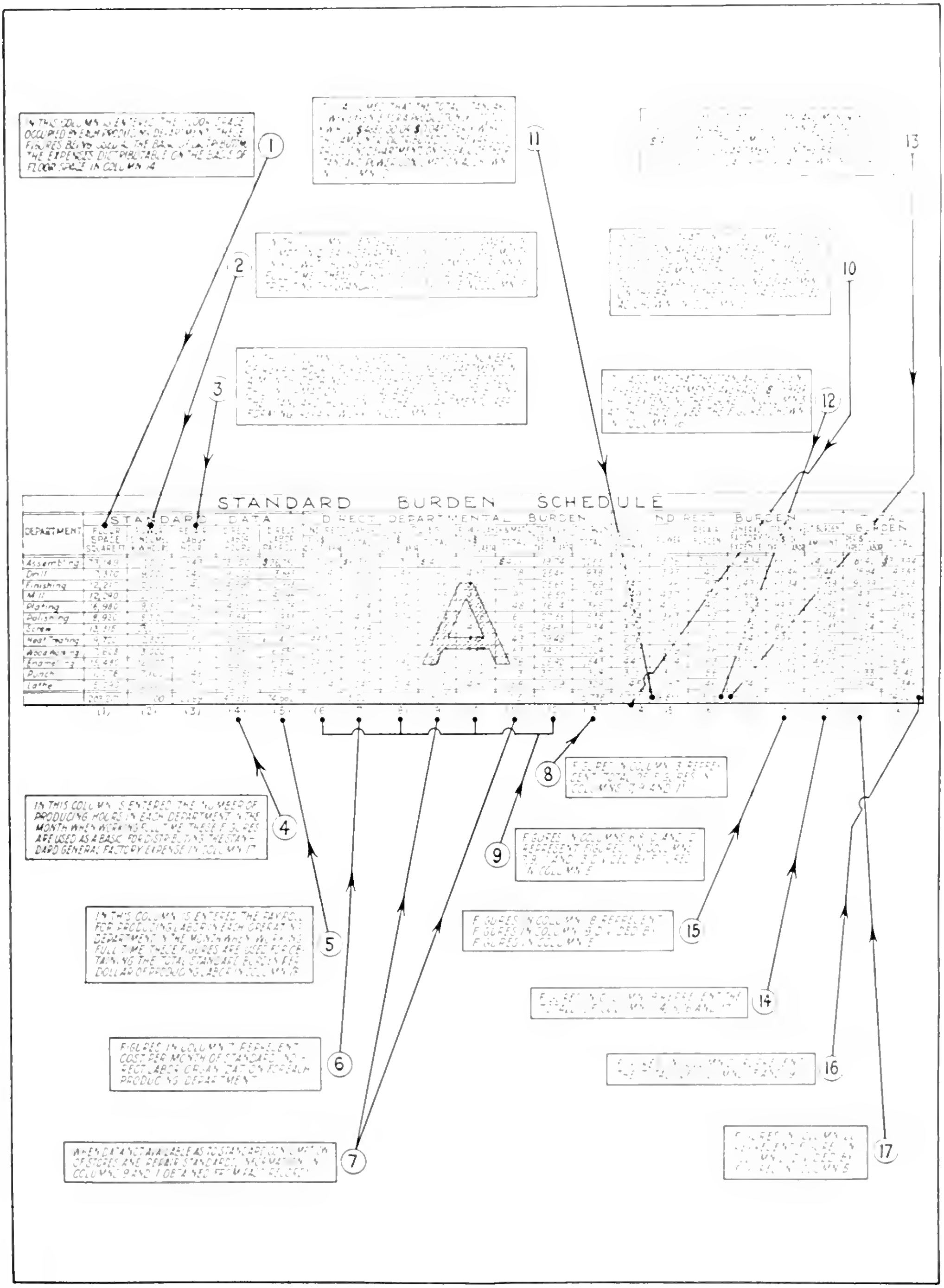


FIG. 1. DIAGRAM ILLUSTRATING METHOD OF COMPILING STANDARD BURDEN SCHEDULE

inevitable overhead costs of an expensive automatic machine as compared with some simple machine which is relatively inexpensive to operate. We may figure, for instance, that the relative overhead costs of these machines is 3 to 1. But what is to be gained by entering into elaborate calculations month after month to determine that this month the relation is as 3.05 to 1, and next month as 2.95 to 1? Can we change our selling prices to conform to these temporary changes in conditions? Assuredly not! Then why go to all the trouble of making these calculations, and incur the delay in the compilation of the cost statements which results from making them when no benefit is derived from so doing?

A Simple Plan of Prorating

In Figs. 1 and 2 a plan is illustrated in diagrams, which reduces the distribution of burden to one proration a month. Details of the routine involved are clearly shown on the diagrams and need not be repeated. The essential features of the plan may be briefly stated as follows:

1. The plan provides for a careful basic distribution of burden to the producing departments on a Standard Burden Schedule (Form A). As this distribution will stand until there is some material change in the conditions, it may be made as elaborately as desired. For purposes of illustration, the direct burden items have been classified as follows:
   - Indirect labor (including foremen, assistant foremen, truckers, shop clerks, etc.).
   - Operating supplies (oil, waste, etc.).
   - Labor and material in repairs and maintenance.

   The indirect burden items have been classified as follows:
   - (*a*) Expenses distributable to the producing departments on the basis of the floor space occupied as, for instance:
     - Heat and light.
     - Repairs and maintenance of buildings.
     - Depreciation of buildings.
     - Cleaning and janitor service.
     - Watch and fire protection, etc.
   - (*b*) Power distributed to producing departments on the basis of their standard power consumption.
   - (*c*) Burden of service departments performing producing department repairs distributed to the producing departments on the basis of their standard repair hours.
   - (*d*) General factory expenses distributed to the producing departments on the basis of their hours of producing labor when operating full time.
2. The total standard indirect burden to a producing department is divided by the standard producing pay-roll of that department, this ratio being referred to hereafter as the indirect burden factor.
3. The Summarized Department Cost Statement (Form B) shows the actual producing pay-roll and expense of each producing department in relation to standard, this furnishing a simple and valuable index of operating efficiencies.
4. On this statement all distributions of burden are avoided except one simple proration, namely, the distribution of the total indirect burden for the month on the basis of the standard indirect burden represented by the production of each department, this being obtained by extending the standard producing labor of the department at its indirect burden factor obtained as explained above in 2.
5. Column 16 of the Summarized Department Cost Statement (Form B) shows the relation of the actual producing labor plus burden for the month for each department to the standard labor for the department, which ratio, as illustrated on Form C, renders it possible to figure the current labor and burden cost of any article with great facility. As an illustration, it will be noted by reference to Form C that the standard assembling labor on article number 274 is assumed to be \$7.20. Applying the current adjustment factor for this department of 194.87 per cent to this amount gives a current labor and burden cost of \$14.03.

It will be noted that the basis for all calculations is the standard producing labor represented by the production of each department in the month, and though it is not feasible within the limits of this article to explain fully the various methods for obtaining this information, some reference should be made to the basic principles underlying this work. Obviously, once a piece rate is established for any operation, this piece rate should be regarded as the standard, and when piece rates are changed the standards should be adjusted to conform to such changes. When this method is followed, therefore, the only variations to be given attention are in connection with operations which are normally performed on a day-work basis, piece-work operations which for some reason or other are done on a day-work basis, extra operations, and re-operations.

"Lot Cost" Systems

Under any circumstances, the figuring of the variations from the standard in the cases referred to calls for a great deal less work than is involved in the labor distributions required by the "lot cost" systems, but as a matter of fact, it is entirely unnecessary to figure the standard for more than a percentage of the time tickets, as sufficiently correct information for all practical purposes can be obtained by making periodical tests. It will be understood that short cuts of this character should only be introduced by the skilful and experienced.

Henry Ford relates the following incident:

> A few weeks ago a visitor who knew our plans rather well three years ago was talking with one of the executives. He mentioned some process familiarly. The executive did not know what he was talking about.
>
> "Don't you remember the way you made that part? I think you showed it to me yourself. It was a new way that had just been devised."
>
> "How long ago was that?"
>
> "Just three years—you surely remember."
>
> "Three years is a long time. A lot of things have happened in three years. There is hardly anything that we are doing today the way we did it three years ago."

In reference to the above, Henry Ford then states:

> These methods are changing so constantly, not because we like changes for themselves, but because the firm policy of striving to lower the price and raise the quality just naturally forces improvements.

The Price and Quality of Cost Accounting

Three years, as Ford says, is a long time, but how many cost accountants have made no important changes

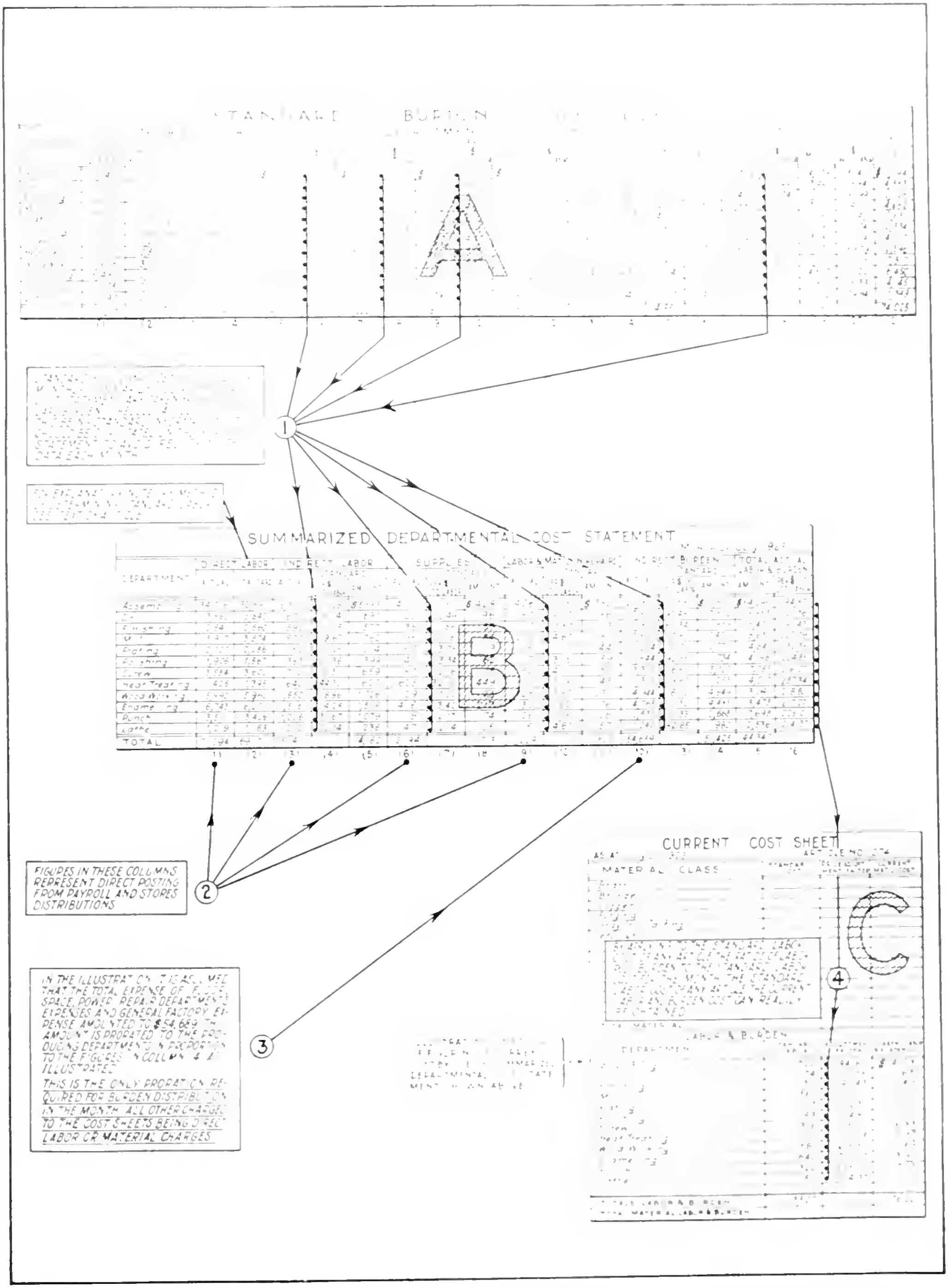


FIG. 2. DIAGRAM ILLUSTRATING THE USE OF STANDARD BURDEN SCHEDULE TO ELIMINATE MONTHLY BURDEN DISTRIBUTION

in their methods in five years—yes, in ten years or more? It is the writer's privilege to be on more or less intimate terms with the comptrollers of some of the largest manufacturing concerns—men of vision and courage—and they are constantly engaged in an effort to "lower the price and raise the quality" of their work; but for one of these there are two of the other kind who sit back and smile contentedly while they state that they are perfectly satisfied with their cost system. In many cases, however, it will be found that the cost systems which they are operating, considered from the standpoint of the quality of the information obtained, are not 30 per cent efficient, and from the viewpoint of expense, cost three times as much as any cost system should, giving a net efficiency of 10 per cent. And yet they are satisfied and will continue to be satisfied so long as they are left alone.

Ralph Waldo Emerson once said:

> People wish to be settled; only as far as they are unsettled is there any hope for them. . . .

and he was right. Outside competition does not permit the manufacturer to stand still in his manufacturing and selling methods and survive, but the accountant is not generally subject to competition and he must therefore supply his own incentive. Probably no large concern in recent years has been less subject to competition than the National Cash Register Company. But was John H. Patterson satisfied merely to make better and more cash registers than anyone else? He was not. He was everlastingly striving to improve on himself. He spent years and enormous sums in developing new types of registers, and today, and for years to come, there will be men in Dayton working out the details of projects started by him. If he thought that a man was satisfied with what he was accomplishing, Patterson fired him on the spot, and he did the same with his cost system.

The high cost of cost accounting is an economic sin. Every comptroller owes it to himself, his concern, and his country to eliminate the waste of money and effort involved in elaborate burden distributions, in the carrying of detailed costs for standard products, and the recording and figuring of the elapsed time on standardized operations. The satisfied comptroller should cultivate a "divine discontent" and should consider the month lost which does not show some improvement in methods, either in quality of information or in the cost of obtaining it. There is never any end to improving cost methods or anything else. Again quoting Ralph Waldo Emerson:

> There is no outside, no enclosing wall, no circumference to us. The man finishes his story. How good! How final! How it puts a new face on all things! He fills the sky. Lo! On the other side rises also a man and draws a circle around the circle we had just pronounced the outline of the sphere. . . .

A Coatroom Which Gives Quick Service

A CENTRALIZED cloakroom does away with most of the lockers in the six-story office building of one of the large rubber factories. Cloaks are checked just as in a hotel—except for the absence of tips—but the service is much faster. An attendant is always in charge, and there is practically no lost apparel.

All employees come into the building through an employees' entrance at one end of the basement, leading into a broad white-tiled corridor with a row of counter-high windows in each wall, opening into a cloakroom on each side, one for women, and one for men. Inside each window is an attendant who takes the apparel and hangs it up. No employee goes inside the cloakroom; there is no opportunity for confusion or dishonesty.

Each window facing on the corridor is labeled with the limits of the cage numbers served by the window. The first window serves checks Nos. 1 to 96, the second from 97 to 192, and so on.

Each employee keeps the same rack number while in the service of the company. The attendant at that window comes to know each one; when he sees a clerk coming down the aisle he reaches automatically to the right cage and hands the wraps out at the window.

Every employee, though known perfectly to the attendant, must actually present a check, and no article is delivered without one. Otherwise, opportunities for dishonesty or accidental loss would creep in.

Most of the attendants are on duty only for a few minutes at morning, noon, and night. These are office boys or girls who are shifted to that duty for 10 minutes in the morning and 20 minutes at noon and at night. The chief attendant does the work during the rest of the day.

Each employee has three checks, which remain on his hat-cage hook until they are issued to him—one for a hat, one for a coat, and one for an umbrella. All three checks bear the same number; if "49" for the hat, then "49C" for the coat, and "49U" for an umbrella.

The hat racks are wire cages, alike for men's and women's hats, built in pairs one above the other, with only one hat in each cage. As the lower tier of cage is 5 ft. above the floor, under each two cages there is room for two coats hung from hangers. Rubbers and overshoes, if any, are laid in the cage beside the hat; and if wet, are placed on the floor beneath the owner's coat. Umbrellas go into racks along the outer wall, one rack corresponding to each section of cages.

The hat cages and coat hangers are numbered by brass tags. The umbrella rack against the wall is indexed not by labeling each individual pigeon-hole, but by a table of numbers on the front of the rack, visible even when the pigeon-holes are filled with umbrellas. Wet umbrellas thus stay down in the basement.

Two restrooms at the ends of the cloakrooms are supplied with benches as an aid to putting on rubbers, and with mirrors to aid girls in putting on their hats. The cloakrooms take up much less space than would several hundred coats and hats scattered throughout the office.

Selling to Retail Dealers

Some Observations on the Problem of Developing More Intelligent Sales Efforts—Based on Field Experience with Forty Salesmen in North, East, South and Middle West Sections of the United States

By H. G. KENAGY

Assistant Director, Bureau of Personnel Research, Carnegie Institute of Technology

SELLING through the local independent dealer is a method of distribution which has always offered many perplexing problems to the manufacturer. In recent years these problems have become either more numerous or more perplexing, if we may judge from the attention which has been given to them in sales literature. One day we read that there are too many retailers; something must be done to reduce the hordes of struggling dealers who add so much to our already excessive distributing costs. Next day we are told that the retailer is a most important ally of the manufacturer, provided the proper plan of dealer co-operation is put into effect. "Give the dealer good selling helps for moving your product, and your troubles are over." Later on we discover that this is mostly wrong. Instead we must send our salesmen out, instructed to get distribution by exerting pressure on the dealers for preferential sale of our goods. This plan seems to merit consideration. But almost immediately we are urged to forget such an idea and turn to advertising for the help we need. Advertising, we are told, will establish consumer preference. No time is to be wasted on the dealer. Instead of spending time and money in attempting to force the retailer to *push* the merchandise from his shelves, we should spend our effort in getting the consumer to *pull* the merchandise from his shelves.

SHOULD the retailer be merely a stocker and distributor of merchandise, handing out what is asked for? Or, taking full advantage of national advertising directed to the consumer, should he aid the manufacturer by demonstrating some real salesmanship?

This article answers the latter question emphatically in the affirmative. It also indicates how the manufacturers' traveling representatives should be trained, not only to sell goods, but to inspire the retailers to be true salesmen instead of merely storekeepers.

Where among all the various ideas about distribution through dealers shall we find the truth? Possibly there is a measure of it in most of the plans advanced. Certainly the last-named—advertising to the consumer—has demonstrated its value in many instances. For example, in some southern states a particular laundry soap has attained a sales volume far in excess of all competing brands. True, it carries coupons with premium offers and this feature makes a strong appeal to the negro washerwoman who is the soap buyer of the South. She cannot pronounce its name correctly, but she recognizes it when she sees it on the shelves. The dealers admit, when questioned, that they do not make much profit on the popular brand. They could buy competing brands for less money; but few of their customers call for the other brands, and they have to give them what they call for.

Few people today would deny that advertising has enormous power in building sales volume. It must be used more and more in this period of highly competitive selling which is upon us. More than that, it must be creative advertising—creating new markets, educating possible buyers, building business generally. But, with advertising alone, even though used most intelligently and effectively, will we have solved our problem of selling through dealers? Hardly.

Complete dependence upon advertising leaves out of account the traditional, deeply rooted merchandising methods of the great majority of retailers. Retail grocers may be taken as typical of retail dealers as a whole. Their chief characteristic is that they are *storekeepers* rather than merchants. They maintain stores of goods and hand out to their customers what these customers call for. The biggest objection the manufacturer's salesman encounters from these storekeepers is: "I don't have any calls for your goods." The dealer will pay more for a popular brand, and sell it on a close margin, rather than create a market for an equally good and cheaper article which is not so well known. In most cases this is entirely apart from a businesslike consideration of turnover and the smaller investment involved. It is principally due to the dealer's desire to handle something which calls for the least sales effort. Probably 90 per cent of our 335,000 retail grocers are primarily engaged in handing out across the counter practically nothing but what people call for.

But this must not be mistaken to mean that consumer demand, built by advertising, has brought the grocer to this condition and robbed him of the possibility for aggressive merchandising. During the past two months, while engaged in a study of retail selling, the writer has gathered data from observations in 800 grocery stores in different parts of the country. A study of the data leaves no room to doubt that the dealer's ignorance of merchandising and his lack of aggressive spirit are chiefly responsible for the well-worn rut in which he finds himself.

Next to his desire to handle goods which he does not have to sell, the most deplorable characteristic of the retail dealer is his method, or lack of method, in buying goods. Because he has calls for several brands of goods in each line; because he wants to treat all salesmen alike; because "special deals" or "free deals" are always coming along; because some salesman offers a big price inducement—for any one of a dozen reasons of equally small consequence, the dealer keeps his shelves and his storeroom stocked almost to capacity with merchandise of many different lines, which he hands out to customers on demand. Naturally he often discovers—perhaps a year after the purchase is made—that he has goods in stock for which there is no demand. In such a case he may put the goods on special sale at a slight price reduction; more rarely he may actually attempt to *sell* the goods. But, instead of learning the obvious lesson involved, he stocks up again on the same or some other equally slow-moving merchandise and goes through the whole process again. The ordinary retail dealer simply cannot resist the appeal of "price brands," free merchandise, or special deals. Because he thinks only in terms of the profit per box or per pound, forgetting the turnover factor, he seldom refuses a hearing to the salesman with a "money-saving" proposition.

Salesmen or Distributors?

Occasionally some salesman, better trained than the great majority who call on retail dealers, really sells a dealer his line of goods. He convinces the dealer that self-interest lies in pushing this particular line and securing volume business. But the dealer still continues to stock competitive lines, or if he does not stock them regularly, he falls victim sooner or later to some salesman who offers a big price concession or free deal. In the dealer's psychology, *saving* a dollar is a much more desirable action than *making* a dollar. It is somewhat like buying a Ford coupé which he does not need instead of a Reo delivery truck which he does need, just because the Ford is cheaper. But the serious flaw in his logic has never been forcibly pointed out to him.

Much has been written about the dealer's ignorance of merchandising methods and his lack of aggressive sales effort. Nowhere have these facts been more glaringly apparent than in the ordinary local dealer's efforts to compete with chain stores. Being unable, so he thinks, to meet chain store prices on established brands, he turns to "off" brands which are inferior, or not well known, but which can be purchased more cheaply. By so doing he loses the established consumers' demand for advertised brands and also loses his customers. Probably he extends credit and gives service in the way of delivery. The result is that customers buy at the chain stores for cash when they have money and come to him when they have not. Bad debts pile up. He moves, or goes into bankruptcy.

This picture of the retail dealer is a rather black one, admittedly. A small percentage of retailers certainly do not belong at all in the same "frame." But, from the manufacturer's point of view, this picture represents the conditions which must be met. In order to meet them successfully we must do more than advertise, and we must have better sales representation than has been the rule in the past. Consumer demand, developed by advertising, must be accompanied by really effective personal contact with the dealer directed toward helping him solve his real problems.

Some advertisers, of course, take issue with this view. They say that the retailer no longer *sells* goods for the manufacturer; he only *distributes* them. An executive of a large advertising agency recently wrote:

> Before advertising, the retailer was the logical salesman for the manufacturer. His influence materially helped or hindered the sale of a given merchandise. With the development of advertising and the multiplication of brands, the dealer's function has changed. He has become a distributor. The modern retailer realizes this and admits it. A fair judgment of the retailer's function, then, is that he is a stocker and distributor of merchandise.

There is much evidence to support this view. The statements made earlier in this article to the effect that the great majority of retail dealers are merely storekeepers would seem to support it. The multiplication of chain stores—particularly groceries—where clerks merely fill the customers' orders, is apparently additional evidence. But there are some equally important facts which show that this view is only partially correct. The first of these is that retail dealers may, and often do, exercise a great deal of influence in determining customer preference for one brand of goods or another. The dealer's recommendation to a customer still carries a great deal of weight. For instance, in the grocery line the modern housewife, of the better classes at least, has her favorite grocer and gives him her trade as long as he renders the expected service. She may have some preferences for certain brands of goods, but she is usually willing to listen to the dealer's suggestions and to try out different brands which he recommends, especially when she is undecided as to what to purchase. In this way, if a dealer merely took advantage of opportunities to help the customer decide upon which brand she would take, or gave preference to a particular brand when none was specified, he could build his sales volume in any direction he chose.

It must also be remembered that there is still a large percentage of customers who do not pay much attention to brands. Furthermore, a large part of those who do buy by brand have no great allegiance to any particular brand and would readily switch to another.

The Selling Power of a Brand

It is impossible to adduce much proof of this fact within the limits of this article. But the results of field investigations of consumers' buying habits are accumulating to the effect that the public is not as yet well educated on brands. Recently an investigation was conducted in the Pittsburgh district to discover how various brands of cured meats were selling. The investigation was comprehensive, and included a questioning of housewives as well as proprietors of meat markets and general grocers. Fully two-thirds of the dealers declared that only a few customers call for meat by brands. One-sixth of the dealers said that customers *never* call for meat by brand; about an equal number stated that customers often bought by brand. Shops in the better class districts were the ones which most frequently had calls for certain brands. In order to check these results, actual records were made of the sales in two large markets on a particular Saturday. Only 3 per cent of the orders for cured meats specified which brand was desired. Meat dealers admitted, on questioning, that consumer demand had almost no effect on the lines they carried. Very few specialized on any brand. They bought on the basis of their own judgment of quality of products, service given, and general treatment accorded by the packer and his representative. In occasional instances the dealer strongly favored a particular line. In most such cases it was discovered that the salesman of the particular packer had been the cause of this attitude.

If a majority of customers do not as yet call for ham, bacon, lard, and sausage by brand, after years of broadside advertising by our big packers, it seems reasonable to suppose that a similar situation may obtain in other lines. This means, surely, that there is great opportunity for the retailer to be something more than a distributor, whether he is taking advantage of that opportunity or not. There are indications that many of them are beginning to take the more aggressive attitude which the situation warrants and demands. With the encroachment of the chain store, the local dealer must become something more than a storekeeper or he cannot remain in business.

There is another angle to the proposition also. Under the influence of a temporary demand, built upon the short-lived advertising campaign of some manufacturer, the dealer who functions merely as a distributor orders a big stock of some commodity. The advertising stops, the coupons soon cease to come in, and the stream of demand for the commodity drops to a mere trickle. On his shelves are many dollars' worth of goods—an investment which is earning nothing and is depreciating in value. This condition is perhaps not inevitable, but it is almost universal. It is chronic with the dealer who is only a distributor.

Selling the Retailer—Present Conditions

Finally, from the point of view of the manufacturer, there is another fact which must be taken into consideration. Salesmen are "working" the retail trade very intensively these days. For instance, at 4 o'clock one Wednesday afternoon, the writer recently called with a specialty salesman at a grocery store in Grand Rapids, Michigan. When the salesman stated his business he was firmly and none too politely requested to leave the store without even opening his sample case. Said the dealer: "You are the twenty-first salesman who has been in here today, and I'm getting damned tired of being bothered. Good by." As we left the store we met another salesman coming in.

As this indicates, special sales effort is the rule, and all sorts of inducements are made to get the dealer to buy. Being human, and being also something less than a real merchant, he buys. The manufacturer who is not represented before the retail trade by salesmen fully as good as his competitor employs, is working at a decided disadvantage. Salesmen are *selling* goods, not only where consumer demand for competing goods is weak or entirely lacking, but in spite of strong demand for other goods. This fact, coupled with the awakening of some retailers to their own best interests in the matter, is creating a situation for the manufacturer which calls for more effective methods than have been employed in the past. These methods, clearly, have to do with the development of more able sales representatives to carry through a plan of real cooperation with the dealer.

Selling the Retailer—the Problem

It might be in order here to describe at some length the type of salesmanship which the manufacturer usually employs in selling to dealers, but it must suffice to say that it borders closely on mere order-taking and seldom approaches the level attained in specialty selling. But the salesman usually has a limited territory, which he covers several times each year, sometimes as often as twice each month. He gets to know his trade personally and secures much business on the basis of personal acquaintance or friendship. Occasionally the salesman finds an opportunity to render some sort of special service to a dealer, and this fact serves to fix the dealer's preference for the particular line of goods offered. Selling to retail dealers, as exemplified by a majority of the salesmen in this field, is a non-skilled occupation requiring little intelligence and technique, but a fair personality and plenty of physical energy.

A small percentage of retail salesmen clearly exceed these minimum specifications. They have enthusiasm and initiative and enough intelligence to develop sales tactics suited to the needs in their territories. They know their goods and they understand the company's sales plan. These are the men who really sell a dealer on a particular line of merchandise and get him to give it preference. They know how to get dealer confidence and they try to keep it by passing out tips, advice, and real information. Many manufacturers today are attempting to recruit or develop sales forces composed of this comparatively high type of retail salesmen.

A sales force composed entirely of such salesmen would, of course, work a large increase in any manufacturer's sales, so long as competitors did not employ equally able and aggressive men. The story of how intensive solicitation of New York dealers by a group of *trained* salesmen, backed by consumer advertising, increased the sale of Shults bread in New York by 25 per cent, is only one of many which might be cited to prove the value of really capable sales representation.

Instead of stopping to argue this point further, let us pass to the problem which follows immediately in its wake. How shall we go about this business of making merchants out of storekeepers? There is no denying the fact that this job is an enormous one. Perhaps a majority of dealers do not know that they are not merchants; they do not know that they need any help. Still another large group resents any insinuation or suggestion that the manufacturer or his salesmen can be of real assistance. An occasional dealer is strongly resentful when some salesman trys to tell him "how to run his business." This latter difficulty is due to poor salesmanship and can easily be avoided; the former presents a problem in education.

Under the circumstances the first move for the manufacturer is to set his sales research department to work studying the problems of the retail dealer and the methods which highly successful dealers have worked out for solving those problems. For example, the manufacturer will discover that a big problem with most dealers is that of getting turnover—of keeping goods moving from the shelves. He will find stores carrying 7 kinds of canned beans, 8 brands of laundry soap, 6 varieties of coffee, 5 brands of canned salmon, 8 different brands of evaporated milk, candy from four different concerns, and so on for every kind of merchandise carried. Some brands are moving; others are not. The total investment is all out of proportion to the amount of business done. The stock turns over less than twice a year and slow-moving items depreciate in value. The solution to this *impasse* is clear. The dealer must reduce his stock, concentrate on one or two brands of each commodity, stop buying "off brands" which cost less but move slowly, and begin to *sell* the lines which he carries. The dealer and his clerks must present their goods to customers just as a good salesman presents the goods to the dealer.

Developing a Sales Force

After the manufacturer's research department has secured the information needed, a campaign built upon it can be outlined. The next real problem is that of developing a sales force capable of carrying the campaign through with the dealers. In many sales organizations a higher type of salesman must be employed than at present; in others the problem is one of better training. But it is right here that the manufacturer has ordinarily failed. Today the majority of retail salesmen are either totally untrained or very poorly trained. It is really astonishing how many concerns depend upon the untrained ability of a poorly educated, inexperienced, and poorly paid salesman, not only to sell goods but to carry out the concern's sales policy and win the respect and confidence of the trade. A salesman is engaged, given a hurried acquaintance with products, policies, and prices, and sent out to sell goods. Ordinarily he works for a few days with an "old head" or a supervisor. Then he is put "on his own" and works out his own salvation, visited occasionally, perhaps, by a supervisor or head salesman.

To make a long and painful story short, retail salesmen of today are not capable of carrying out the program of co-operation with dealers which meets the needs of the situation. Many are lacking in ability; few have had worth-while training. Furthermore, such training as has been given has not been concerned with that knowledge of retail merchandising which is essential to worth-while co-operation with dealers. Manufacturers' representatives must be merchandisers first and salesmen second. The selling of goods must really be a secondary matter.

One of our prominent adding machine companies has recently taken this attitude strongly. For some time the company has made accountancy and business system the basis of training for its salesmen. Now it has laid down the rule that when a salesman makes his first call on a prospect, he shall not mention the company's products. It is his job to apply his expert knowledge to the accounting and record problems of the prospect and to give constructive advice and assistance in as many ways as possible. If, in his study of the prospect's problems, he discovers a distinct need for some item of equipment manufactured by his company, he is expected to use this fact in presenting the machine, at some later date. The initial contact with the prospect must always be a serious effort to help the prospect improve his business methods.

Service to Retail Dealers

The National Cash Register Company seeks to accomplish the same purpose, but uses a different method. It maintains a special department whose sole function is to give free service to retail dealers on any and all retail problems. This service is largely given by correspondence, but it covers an extraordinarily wide range of problems, few of which have any connection with the uses of cash registers. The department gives the best service it can on each inquiry, and the matter ends there. The company makes no follow-up on those who have received service; they are not considered prospects. But experience has proved that this disinterested service makes friends for the company and thereby builds business.

The idea which these specialty companies are exploiting so successfully, can be taken over by manufacturers of staples with equal success. Butler Brothers of Chicago have been working along this line for years. But it must be remembered that success depends largely upon ability to recruit a force of high-grade men, to train them in aggressive merchandising principles, and to send them out with the zeal of missionaries to educate the dealers—to make merchants out of storekeepers.

The retail dealer must not be considered a mere stocker and distributor of merchandise; consumer demand cannot be depended upon to pull merchandise from his shelves. The retailer, potentially and actually, is a powerful factor in determining the sales volume of any particular commodity. His knowledge of, and his belief in, a given manufacturer's line are matters of extreme importance to the manufacturer. It is therefore vitally necessary that the manufacturer's salesmen should be carefully and adequately trained, not only to sell goods, but to turn the dealer into a merchant.

Working Methods for Profitable Management

VII—Rewarding the Workers

By C. E. KNOEPPEL

President, C. E. Knoeppel and Co., Inc.

"HELL, man, if you ever attempted to 'horn in' on the time of the general manager of this company, with all that dirt and grime on you, you'd be thrown out on your ear! Who do you think you are?"

Three men were seated together in the yards of the Benson Machine and Construction Company[1] following lunch. The talk had drifted around to the matter of wages, and Mike King, a steel molder, had been telling Gus Bates, a machinist, and Phil Wilson, a structural worker, some of his ideas on the subject of wage payment, ending with the statement that he believed the ideas of the workers would be of interest to the company, but was puzzled as regards how to get to Gibbs, the general manager. Bates had taken him to task in the above words.

"You know damned well, Bates," said King, "that the wage plans here are neither fair to company nor men. We have had a little of everything—day work, bonus, different forms of piece-work, premium plans, and group incentives. It's high time we got a new deal in wages."

"Yes, I grant you all that, but what chance have we guys got to put anything over in this or any other plant?" said Wilson.

"None a-tall," replied Bates, "and if King here wants to get himself fired, the way is for him to try and see Gibbs."

"Say, you wet-blankets," was the rejoinder of King, "is there any better bunch in the world to talk wages than those who get 'em? Haven't all three of us been in these shops long enough to know what's wrong with a lot of things here? We may be shy on parlor manners, but we have had the hard knocks of experience, haven't we? You birds make me tired."

"We're with you, Mike, on all but that getting to Gibbs stuff. Forget it!" said Bates.

"I'll bet you a week's pay check," said King, "that if this company would let us workers help to cut out the faults we see every day, which put the kibosh on our earnings, there would be something in it for everybody. Am I right?"

"You're sure shouting, Mike," said Wilson, "but try and offer the help and it'll be flowers and slow music for yours."

"Couldn't we show the company a lot that's wrong with the wage plans here if we had a chance?" persisted King.

"Yes, if we had eggs, we could have ham and eggs, if we could only find the ham," was the parting shot of Bates as the whistle blew.

"Well, think it over, buddies," said King as he started for the steel foundry.

Following lunch the next day, King, Bates, and Wilson met as was their usual custom, and after greeting each other Bates said to King—

"I have been stewing over your ideas, King, and I don't know but what you have hit on something that would get us somewhere. There's been a lot of talk lately about meetings the bosses have been holding for the purpose of improving things around here, and it may be that the plans are to discuss wages. If so, we ought to be in on it, but just how we can 'butt in' without being misunderstood or fired, is what I can't figure out."

"Well," said Wilson, "I've been thinking about that, too, and I agree with Bates that we workers could help this company a lot if it would let us, and I'm game to make the try. But I'm like Bates; I don't know just how we can connect. Have you anything in mind, Mike?"

"Well, of course, Phelps, the personnel director, is the man who has such matters in hand," said King, "but I don't see how we can get to him first. We don't want to go over the heads of our foremen and get 'in Dutch' and —— Say! why couldn't we sound out Tom Scott? He is production supervisor, and a square fellow even if he is a hard guy on getting out production. He gets around a good deal and I'm sure would listen. He could get to O'Grady, the big boss next to Gibbs, and the rest would be easy."

"You're elected, King," said Bates. Wilson agreed.

Late that afternoon when Scott was passing through the steel foundry, King spoke to him and asked if he had a few minutes he could give him.

"Sure, King, what's on your mind?" asked Scott.

"A couple of buddies of mine have been talking things over with me the last two noon-hours," said King, "and we believe we see how we could help this company a lot if it would let us, without feeling we were a 'grievance committee' from the men. Being in the thick of things all the time, we workers see a lot that raises hell with production, and all this in the end hits our pocket-books. We are selfish, of course, in wanting all the money we can get, and I'm sure there is enough wasted every day to give the company and us a bigger slice than we get."

[1] Preceding articles in this series were published in MANAGEMENT ENGINEERING, January 1923, p. 9; February, p. 93; March, p. 157; April, p. 245; May, p. 321; June, p. 409.

"What do you want, King, more wages?" asked Scott.

"Not directly, Mr. Scott," answered King, "but if there was some way for us to get together and co-operate, don't it stand to reason that there'd be more in it for us? We've had all kinds of experience with wage plans here, and I'm sure we are not on the right track yet. There are plenty of men in these works who'd get on the band wagon if we could help, and out of the results get more coin of the realm."

"Well all I can say, King," said Scott, "is that you're on the right track. Let me handle this and perhaps something will come of it."

The next morning Scott walked into O'Grady's office and briefly reviewed his discussion with King, without mentioning names.

"A few months ago," said O'Grady, "I would have canned any workers trying to butt in, in this way, but so much has happened this year to show the value of the joint exchange of experiences and ideas, that I feel differently.

"I'm sure enough that if our workers would 'loosen up' and really co-operate with us, there would be a lot more in it for us and for them. I suppose we are 'dubs' in the eyes of our hard-handed sons of toil. We are going to consider wage plans and Gibbs has delegated Phelps to call meetings on the subject. Your mentioning this to me comes at the right time, and I'll see Gibbs."

Arranging an appointment with Gibbs, the vice-president and general manager, the factory superintendent laid before him the substance of his talk with Scott, and Scott's recital of King's views.

Gibbs listened thoughtfully and after calling in Phelps and explaining matters to him, said—

"I'm not surprised. I've long felt that our workers could contribute a lot to the common fund of knowledge here, and there is no question in my mind that we can develop some wage plans which would mean something to our men, and get us a degree of co-operation from them that would materially influence results. Who is this worker, O'Grady?"

"Scott didn't say," said O'Grady, "and I suppose he didn't want to run any risk of getting him in bad."

"That is not important, now," said Gibbs. "What do you think, Phelps, of letting our workers in on this work of developing wage plans?"

"It would be one of the best things we could do," replied Phelps, "for if management and men could ever meet over the same table, I'm sure the results would prove of extreme value to both. I'm with you."

"All right, Phelps, go to it," said Gibbs, "and get that worker and his two pals, and more if you want, to work with you and those representing the management you may have in mind to assist you. You'd better get those workers in first and make them feel easy and at home."

That afternoon Phelps arranged through Scott for King, Bates, and Wilson to meet him in his office, after O'Grady had paved the way through their respective foremen. Gibbs was on hand to start the ball rolling and after the workmen had been asked by Phelps to sit down and not worry, Gibbs said—

"Well, men, this is as new an experience to us as it is to you. I am told that you have shown an interest in our affairs and that you have ideas on working with us and helping revamp wage methods that are quite unusual, or I might say the idea of getting it over to us the way you have is unusual. I see a new era ahead for this company when men and management get together and discuss common problems. We have been uncovering a lot of wastes this year, but you men can tell us where a lot more are, especially if the elimination of them carries with it tangible rewards. We welcome you and want your help."

Then Gibbs shook hands with the men and went out, and Phelps briefly outlined the situation.

"We want to take up this whole matter of wages. We have been discussing executive organization, economics, accounting, and costing matters, production control, and simplifying conditions and operations. Everything is now ready for us to develop a wage-payment plan, which will be fair and profitable to both company and men. Now make yourselves at home, feel free to say what you have on your minds, and rest assured that you are not going to be fired, intimidated, or ridiculed for working with us, in fact, if you think it desirable, we can bring in other workers from time to time. I'll send for some of those who should 'sit in' on this meeting, and we can then get under way."

To his secretary he gave the names of the following to join the conference: James Cannon, assistant factory superintendent; Philip Douglass, chief inspector; William Gordon, tool supervisor; Tom Scott, production supervisor; John Graves, newly appointed mechanical betterment supervisor; and Tyson, Williams, and McNamara, the foremen of the steel foundry, the machine department, and the fabrication end of the structural shop.

When those sent for were finally seated around the conference table, Phelps explained what the meeting was for and mentioned the voluntary assistance of the three workers present.

"I do not know," continued Phelps, "of a more difficult problem than the one of wages. Touching a man on his money side is like exposing a nerve in a tooth. I have no idea that we can completely solve the problem for all time, but I do believe we can make some headway, especially in view of the fact that we have workers, foremen, and executive management here represented. In all that we do in these meetings we must keep this thought constantly before us—*that there must be high earnings to labor and low cost to company, and that as to fairness what we do must be on a fifty-fifty basis.*"

"I can't see that there is a great deal to talk about," said Douglass the chief inspector. "I have been with this company nearly 20 years, and there isn't much in wage-payment plans that we haven't tried."

"Yes, and everything that we have tried has fallen short of the mark," said McNamara, "and had to be junked. This is only another perennial spasm, but this time I think we are on the right track."

"Mr. Phelps," asked Cannon, the assistant factory superintendent, "what do you think the essential elements are in a good plan?"

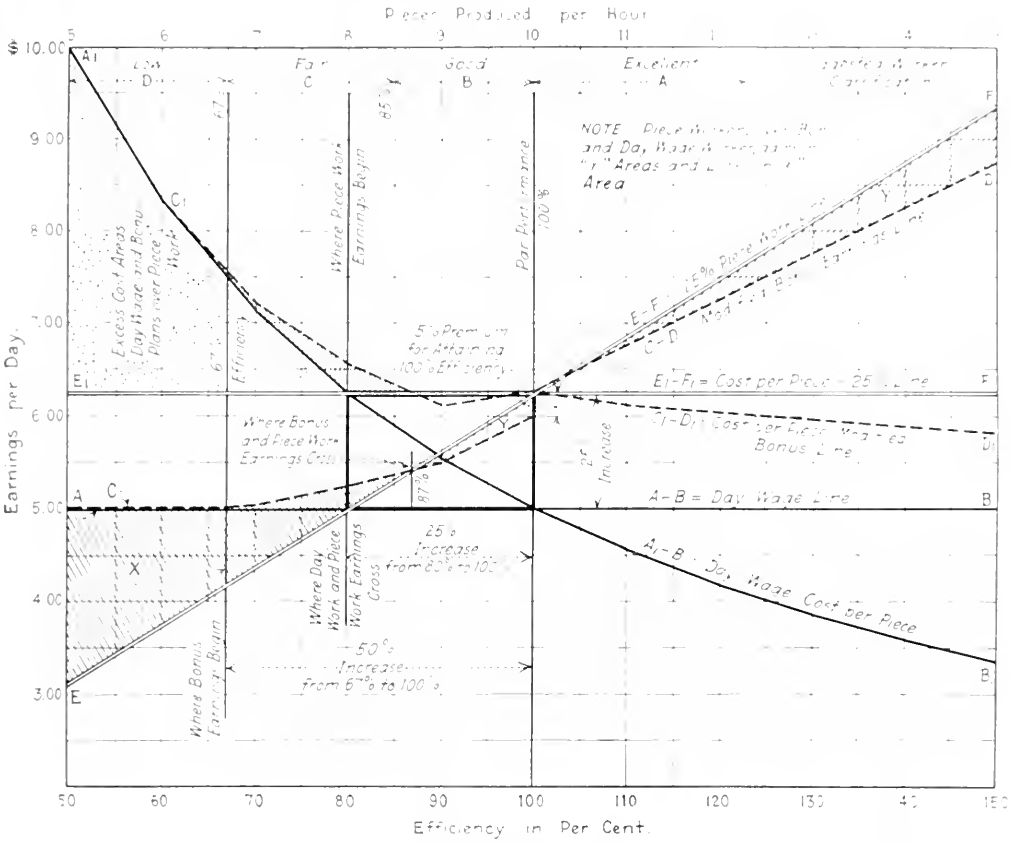


FIG. 15. CHART SHOWING COMPARISON OF WORKER EARNINGS AND COST PER PIECE, DAY WORK PLAN AND BONUS PLAN WITH PIECE-WORK PLAN

"Well," replied Phelps, "I've been giving the matter quite a little thought since knowing that the task of developing better wage plans has been put up to me, and I should say we might follow a plan like this:

1. That whatever is worked out must be built on the principle of payment according to results.
2. That quality as well as quantity must be considered.
3. That due consideration must be given to men who are delayed through no fault of their own.
4. That fatigue must not be overlooked.
5. That earnings should be proportionate to effort expended.
6. That initiative and invention must be rewarded.
7. That the plan must be simple as to application and calculation by company.
8. That it must be easily understood by the rank and file of our workers.
9. That there must be no penalizing of workers who through skill and hard work make high earnings."

"*Some* specification, I'll say," exclaimed Gordon, the tool supervisor. "What plan is there in use that will meet those nine points?"

"None so far as I know," answered Phelps, "but there is nothing as I see it, to prevent our developing something that will conform to them."

"Well," said Cannon, "there are some plans that we know will *not* work. I've battered around industrial plants more or less, and I've come to know something about most all the plans now in use. Certainly the straight day wage plan can be discarded; it doesn't fit the points Phelps has mentioned. I doubt if straight piece-work, as we have seen it operate, is the answer, because as it usually works, even here in this plant, it is a pass-the-buck game.

"Differential piece-work has merit, but the plan punishes as well as rewards, and while in a plant employing high-grade mechanics, it may work well, in the average plant it comes pretty hard on men of only average and fair ability. A bonus plan paying high rewards at 100 per cent efficiency, but no proportionate rewards under 100 per cent doesn't seem to fit Phelps' specifications, as I fully believe that effort, interest, and exertion are entitled to partial reward for partial performance over a day-work task. A bonus plan starting to reward at 67 per cent efficiency and paying 25 per cent at 100 per cent efficiency, with 1 per cent in earnings for each 1 per cent increase in efficiency above 100 per cent has a lot in its favor, but it falls somewhat short of what Phelps wants. It is too hard to understand, for one thing, and then, too, it makes low efficiency work cost too much and does not pay enough for high efficiencies. Certainly profit-sharing don't fit in at all. Premium plans don't fit either, as I see it, for the way they work is to say to a worker that if 1000 pieces is a stunt and he makes 2000, he will get paid for 1500."

"That's certainly a hop-skip-and-a-jump through wage plans," said Phelps with a laugh, in which the others joined, "and you've brought us all up smash against a stone wall. Where do we go from here?"

"Here's a point," said Scott, "which might help in starting us off. Phelps said there should be payment according to results. My idea of this means that individual or group attainment or performance should govern rewards. As production control supervisor, I believe that practically everything that we do can be reduced to some form of standard or estimate, against which we can measure what is done. This, to my mind, is a fundamental point in any scheme of wages."

"Yes, and not only that," said King, the molder, "the reward ought to be paid pretty soon after it's earned, within a month if possible or perhaps weekly. The worker, you know, is a 'by the day' thinker, and a prize that is six months or a year off and that we may not get at all, is not going to interest, for very long, us fellows whose viewpoints are within pay-roll dates."

"There is another point we must consider in this connection," said Douglass, who as chief inspector, had had a most excellent opportunity for studying work, "and that is that rewards should be based on elements within the workers' control, and not something like bad debts or unnecessary expenditures in advertising, or low volume of business in the shops, which they have no 'dip in' on."

"And if I may carry that point a step further," said King, "the workers ought to be paid the reward they have really earned—based, as you say, on those elements they can control—regardless of whether the company makes or loses."

"I don't get that at all," said Tyson, the foreman of the steel foundry, "if the company loses how can the men make?"

"Here's my point, Mr. Tyson," said King. "If you ask me to do a certain stunt, and I do it or better it to your satisfaction, and you have promised certain rewards and I earn them, shouldn't I be paid regardless of whether the company makes money or not in that month?"

"King is right, Tyson," said Phelps, "for rewards promised and earned are payable."

"Yes, I now see his point," was the reply of Tyson. The general discussion of the four points brought out produced the following summary:

1. Payment in proportion to individual attainment.
2. More or less immediate payment for results secured.
3. Plan to be based on factors within the control of the workers.
4. Rewards earned to be paid without reference to company showing.

"It is clear in my mind," said Cannon, "in light of all that has been said, that we are headed for some form of piece-work, in which the flaws so often met with are removed, and the good points in other methods of wage payment are incorporated."

"I can't help but feel the same way," said Phelps, "so that it would seem in order to consider the flaws."

"Rate-cutting is one of them," exclaimed King.

"I'll say it is, also guesswork and snap judgment in setting rates," said Bates, "which either don't give the worker enough, or if he makes too much, then as King said the rates are cut."

ALLOWANCE CARD					
Worker			No.		
Dept		Class of Work		Machine	
is Entitled to Allowance Described below					
Reason—			Cause —		
Finished		Class Rate	Cost	O.K. Dispatcher	
Started					
Elapsed				O.K. Foreman	

FIG. 16. ALLOWANCE CARD

"Yes, and there's too much 'pass-the-buck' in piece-work as we know it," said Wilson, "for when a rate is set and put up to us, it is up to us to make wages or go without, unless day wages are guaranteed. You feel your task is complete when we get piece-rate jobs, but how in hell can we control the conditions of machines and tools, kind of material, delays for one reason or another, incorrect drawings and gages, and the like."

"Then there's another flaw," continued Wilson, who was taking full advantage of his opportunity as a worker to get his say before the management, for the first time in his life. "If the production rate is set at a figure which we can in time make, then we take low earnings at the start until we get familiar with the work. If set at the figure which will pay good money at the start, the wages in time are greater than you want to pay, and then, the axe."

"One of the worst flaws," said King, "that comes out lots of times, is not getting paid for bad work when the defect is not the fault of the man on the work at the time, but may be due to the carelessness of some other worker, or bad material, or faulty conditions."

"Well you men have certainly uncorked something, haven't you?" said Phelps.

"In all fairness though, they're right, Phelps," said Cannon. "I've been a worker myself and I agree with them fully."

"Yet, Cannon," said Phelps, "so far the *real* flaw has not been touched upon. While deploring, as do you and these workers, the cutting of rates, there is such a thing as a legitimate adjustment and I can best get it before this group by asking these workers two questions. When business is brisk and when prices and therefore the costs of living, are high and jobs are easy to get, you workmen want *more* in earnings for the same amount of production, don't you?"

Phelps was answered in the affirmative by King, Bates, and Wilson, in decided fashion, little realizing what the next question was going to be.

"All right," continued Phelps, "when business is dull and when prices and therefore the costs of living are low, with jobs hard to get, and men walking the streets out of work, you men will take less for the *same* amount of production won't you, and the company wants and should have lower costs per piece in such times, shouldn't it?"

The three workers joined in the hearty laugh which followed, for they could see that the shoe was on the other foot, with nothing wrong with Phelps' logic.

"You've got us there, Mr. Phelps, where the hair is short," reluctantly admitted King, "for we know only too well the effect of bad times on us and our families, and our efforts in good times are only to 'get while the getting is good,' so as to average up."

"We have no quarrel with you as to that," said Phelps, "for as a company, *we* have to cut prices and take losses in dull times, and get all we can in price when business is good. It's a poor rule which won't work both ways. The point I am leading to is this — a piece rate has been looked upon as something that ought not to change, when in reality it ought to change, and that's why there is a distinction, at least in my mind, between a 'cut' in rates and an 'adjustment' in rates. The trouble is because piece-work in the past hasn't 'squared' with seasonal or cyclical changes in business, due to economic conditions beyond the control of the individual employer.

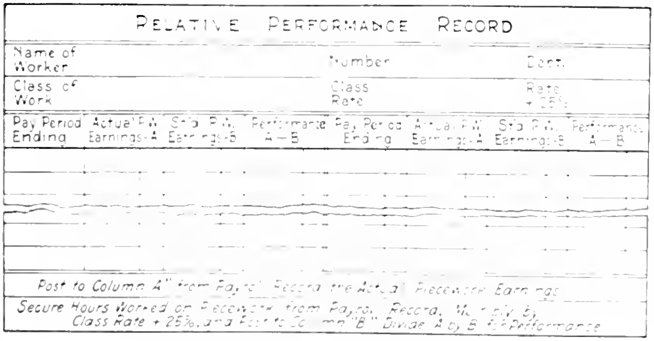


FIG. 17. RELATIVE PERFORMANCE RECORD

"Let me prove this to you men," continued Phelps, pulling a sheet of paper toward him, and figuring rapidly. "A day rate, A, plus a piece-work percentage, whether 20, 25, 33 1/3 or 50 per cent, B, divided by the pieces which should be produced per hour, C, equals the piece rate D. If A, B, and C never change, then of course the piece rate D will not change, but a moment's reflection will show you that the day rate, A, is what is called a 'variable,' that is it *varies as business is good or bad*, resulting in a scarcity of labor at one time and plenty of it at another. Therefore, any formula containing a variable means that the result is a variable, regardless of the number of constants there may be in the formula."

"That's why, I suppose," said King, "that you added a bonus of 20 per cent on piece rates during the war and took it off when the slump hit us?"

"Exactly," answered Phelps.

"Yes, and in a plant where I was recently employed," said Cannon, "they asked more pieces per hour during the war and fewer pieces during the slump. I also heard of several cases where earnings went so high with low quality during the war, that the whole piece-work plan was yanked out when the slump hit them, day-work being substituted, and then when business began to get better, low productions were the order, and piece-work was reintroduced."

"All right men," said Phelps, "we have already taken a lot of your time and I'll appoint a small committee made up of Cannon, King, Douglass, and Scott to develop something and report to us later."

After a number of conferences on the part of the smaller committee, Cannon notified Phelps that it was ready with a report. Phelps sent for those who were in on the first deliberation, and after the meeting was called to order, Cannon was asked for his report.

"In the first place," Cannon said, "we call the plan we have developed, 'economic piece-work' for as we will explain, it squares with fundamental industrial economics. Then also we have developed a plan which carries with it *no piece rates at all*, yet it is piece-work. We have also decided not to state tasks at 100 per cent efficiency, *but at the equivalent production for day wages.* Another principle we have agreed to is to pay 1 per cent increase or decrease in earnings for each 1 per cent increase or decrease in efficiency from day work productions, and we have discarded guaranteeing day wages when earnings fall below them.

"We decided that we would call 100 per cent efficiency 'par performance,' because of the ease in knowing what par performance meant, also to get away from the expression 100 per cent and the word efficiency. We agreed that a 25 per cent increase over day wages would be sufficient to induce workers to move up from 80 to 100 per cent, the increase in production amounting to 25 per cent or 1 for 1. We decided not to set any limit on what a man could earn when attainments were greater than par performance.

"We discovered on investigation that on the basis of a 25 per cent differential, day wage and piece-work earnings and cost per piece to company crossed at 80 per cent efficiency, so we established this ratio as our dividing line between increased earnings, on the one hand, and decreased earnings, on the other, as compared with day work production."

Cannon passed around to those at the meeting a chart (see Fig. 15) showing comparisons of wage-payment plans, a rate sheet (see Table 2), an allowance card (see Fig. 16), and a relative performance record (see Fig. 17), along with a complete and detailed description of the plan.

"As you will see from the chart," continued Cannon, "the earnings to worker and cost per piece to company are shown for the day wage plan, for a modified bonus plan, and for the piece-work plan we have developed. We have discarded day work and bonus after observing effect on cost per piece, and in addition, you will note that the piece-work plan pays *more* for high efficiencies than either bonus and day work. Of course, the worker gets less on piece-work than on day wage or bonus plans, if he falls below 80 per cent efficiency, but with the safeguards we have provided this will not operate against the worker, excepting in cases where the worker is himself to blame for low productions."

"Did I understand you to say, Cannon, that you would have piece-work without piece rates?" asked Phelps.

"Yes, in effect that is exactly what I mean," answered Cannon. "Piece rates should rise and fall with economic rise and fall, and this is what we will automatically get and without any recalculation of rates from time to time."

"I don't get that at all," said Phelps, and it was plain to be seen that those not in on the committee discussions didn't either, although King, Douglass, and Scott smiled at the impression Cannon was making.

"The essentials of the plan," said Cannon, "are a *hiring rate* which will be paid a man until he can show what he can do. As soon as he has passed muster, he will go on a *class rate*, which class rate will be the group rate covering an occupation or group of workers doing approximately the same kind of work. This class rate will be somewhat higher than the hiring rate, and will be that rate which in regular piece-work practice would be used as the *base* for adding the 25 per cent differential for par performance."

"We will study jobs," said Cannon, "and determine par performance for various operations, *but instead of adding 25 per cent to the par performance, we will multiply the par performance by 80 per cent and divide the pieces per hour representing 80 per cent into the class rate, which will mean a rate per piece at day wage or class rate.*

"Here is how we will work it out. You will see by that rate chart, that the class rate is 56 cents per hour. Pieces per hour are shown from 1 to 100, and opposite each increment is the rate per 100 pieces which when multiplied by the pieces per hour desired will equal 56 cents as for instance—26 pieces per hour at $2.80 per 100 pieces equals 56 cents; 40 pieces per hour at $1.40 per 100 equals 56 cents; 80 pieces per hour at 70 cents per 100 pieces equals 56 cents. Naturally the workers' cards will show class rates and pieces per hour desired.

"Now regardless of what time the pieces are made in, or the number of pieces made in a given time, the clerk will refer to the class-rate chart and multiply the pieces produced by the money figure opposite the pieces per hour corresponding to that on worker's ticket, and insert the earnings. Later on a 56 cents worker may become a 64 cents worker, or a 50 cents worker, and I am speaking of class rates. The clerk, however, will simply work from the 64 cents chart or the 50 cents chart instead of the 56 cents chart.

"All recalculation of rates is avoided, and we get away from a rate per piece for each operation which would be looked upon as a constant. We simply work from charts, knowing class rates and pieces per hour desired at 80 per cent. If the worker makes more or less pieces than the number called for per hour, he is credited with more or less in earnings, and paid accordingly."

TABLE 2. RATE CHART

Day-Rate Class—56 Cents Per Hour

Pieces per Hour	Rate per 100 Pcs.	Pieces per Hour	Rate per 100 Pcs.	Pieces per Hour	Rate per 100 Pcs.	Pieces per Hour	Rate per 100 Pcs.
1	56.000	26	2.154	51	1.098	76	0.737
2	28.000	27	2.074	52	1.077	77	0.727
3	18.667	28	2.000	53	1.057	78	0.718
4	14.000	29	1.931	54	1.037	79	0.709
5	11.200	30	1.867	55	1.018	80	0.700
6	9.333	31	1.806	56	1.000	81	0.691
7	8.000	32	1.750	57	0.982	82	0.683
8	7.000	33	1.697	58	0.965	83	0.675
9	6.222	34	1.647	59	0.949	84	0.667
10	5.600	35	1.600	60	0.933	85	0.659
11	5.091	36	1.555	61	0.918	86	0.651
12	4.667	37	1.514	62	0.903	87	0.644
13	4.308	38	1.474	63	0.889	88	0.636
14	4.000	39	1.436	64	0.875	89	0.629
15	3.733	40	1.400	65	0.862	90	0.622
16	3.500	41	1.366	66	0.848	91	0.615
17	3.294	42	1.333	67	0.836	92	0.609
18	3.111	43	1.302	68	0.823	93	0.602
19	2.947	44	1.273	69	0.812	94	0.596
20	2.800	45	1.244	70	0.800	95	0.589
21	2.667	46	1.217	71	0.789	96	0.583
22	2.545	47	1.191	72	0.778	97	0.577
23	2.435	48	1.167	73	0.767	98	0.571
24	2.333	49	1.143	74	0.757	99	0.566
25	2.240	50	1.120	75	0.747	100	0.560

"But the worker will want to know his rate per piece for what he is working on won't he?" asked Bates.

"The clerk can tell him what the rate per 100 pieces is *at his 56 cents class rate*," answered Cannon. "Don't you see that what we put before the worker is *one* thing—pieces per hour to earn, in the case illustrated his class rate of 56 cents, and that if he makes 25 per cent more pieces (or par performance), he will be paid 25 per cent more money; 50 per cent more pieces, 50 per cent more money?"

"I get you," said Bates, "but supposing he produces less than the pieces asked for class rate?"

"Then he will be paid that much less by the number of pieces he falls short of the 80 per cent figure," answered Cannon.

"Is that fair to the men, who ought to get wages at any rate for being at your disposal in your plant?" asked Bates.

"All right, let's cover that factor of fairness," said Cannon. "In the first place a man won't be put on this piece-work plan until he shows that he can make

80 per cent of par performance, during which time he will be on his *hiring rate*. Then when he qualifies as a piece-worker, he will jump to the *class rate*. Workers on piece-work who have to lose time through no fault of their own will be paid for the time so lost, at the class rate, or if extra time is spent on work which is not standard, like hard castings, or material out of shape, or other reasons, the extra time will be paid for at class rate, the authorization for all of this being that 'allowance card' you have in your hands. Starting workers in this way, and allowing for trouble out of the control of the worker, puts doing 80 per cent or better right within the control of the worker, and if he goes below 80 per cent, why should the company pay him for his inability or unwillingness to make at least 80 per cent?"

"How about getting the work started?" asked Phelps.

"We have, as a committee, decided on *temporary* and *permanent* tasks," answered Cannon. "Temporary pieces per hour would be developed as quickly as possible, by consulting past records and talking with foremen and men. The temporary rate would not be changed unless methods of manufacture were changed, until careful studies were made and permanent pieces per hour set. After these permanent rates are set they will remain in effect until methods of manufacture are changed. This will mean rapid introduction, and result in both increased production and greater earnings, as against the slower plan or more or less scientific tasks set on the start in each case."

"But there are some of our best workers," said Williams, the machine shop foreman, "who do the kind of work that can't be put on piece-work. How about them?"

"We think we covered that," answered Cannon, "by providing a special rate. We figured that there would be men who work on special, or complicated, or high-grade, or small, or odd jobs, the difficulties making it impossible to set tasks. To such we suggest paying a rate approximately the average of the piece-work earnings per hour for their class of work, plus 10 per cent."

"Getting back to economies," said Phelps, "what will be the basis of that shift you speak of from one class-rate chart to another?"

"Class rates," said Cannon, "should be changed only when the rise and fall in them are sufficiently pronounced, and then only after conference between the manufacturing, personnel, and rate-setting heads of the business, which changes should be duly authorized by Mr. Gibbs or Mr. O'Grady."

"But how would we know when to change?" persisted Phelps.

"My reply," answered Cannon, "is that statistics should be maintained covering class wage rates and hiring rates, and monthly and yearly charts made therefrom, along the lines of a Babson chart, so that changes in class and hiring rates would not be a matter of judgment and bargaining alone, but would reflect the conditions from time to time both in the country and in our locality."

"You have not said anything, Cannon, about the matter of relative performance of workers," said Scott.

"That's right, I overlooked a very important point," said Cannon. "In our discussion we felt that it would be well to have an individual or gang record of relative performance of workers. You have a card in your hands marked 'Relative Performance Record.' Of course, the actual piece-work earnings divided by the standard piece-work earnings will give the relative performance in per cent. To determine the standard piece-work earnings, it would only be necessary to multiply the hours spent on piece work (which can be secured, so we find, from the pay roll record) by the standard piece-work earnings per hour, which is the class rate plus 25 per cent. The actual piece-work earnings are shown on the pay roll record now, so they can easily be secured and entered on our record. Dividing actual by standard gives our performance percentage, and only one entry is necessary per day period. The totals for all piece-workers in a department, upon dividing, would give the average relative performance of that department, and the same reasoning applies as to other departments, and all the departments by shops and plant."

"How about fatigue?" asked Bates.

"We decided to divide work," answered Cannon, "into (*a*) non-fatiguing; (*b*) semi-fatiguing; and (*c*) fatiguing. For the (*a*) work we would set tasks on the basis of a 60-min. hr.; for the (*b*) work, a 52- to 57-min. hr.; and for (*c*) work a 45- to 52-min. hr. In this way we could make a distinction between kinds of work in considering fatigue."

"Supposing workers should be given work not covered by pieces per hour desired, and that time and nature of work prevented estimates or studying, then what?" asked Bates.

"In that event," replied Cannon, "our recommendation is that the average relative performance shown by the worker for a period of one to three months be used for calculating their earnings for times so spent."

"Could extra amounts be paid foremen?" asked McNamara.

"The best basis possible exists for doing so," answered Cannon. "The average of the relative performances of a foreman's men could be used, after giving due consideration to the proportion of his men on piece-work, and the proportion of their time on piece-work jobs."

"Could your plan be used for groups of men, like a fitting gang in my shop, or an assembly gang in Montgomery's shop?" asked McNamara.

"Yes, gang tasks and gang class rates could be worked up and used as easily as for a single individual," was the reply of Cannon.

"How about set up times in your recommendations?" asked Williams.

"We suggest," answered Cannon, "that set-up work be considered independently from operations, through putting set-up on piece work, or having set-up men on special hourly rates."

"Shouldn't schedules be kept of the pieces wanted for the various operations put on piece-work?" asked Phelps.

"Certainly," said Cannon, "and they should carefully and fully define all the pertinent conditions, and show both par and 80 per cent performance. Then if any changes are contemplated, there will be a basis for comparison and changes explained and justified."

"How do you propose to reward a worker for a valuable suggestion?" asked Phelps.

"Our idea," answered Cannon, "would be not to change the task on this worker for a year following the introduction of the improvement, so that he would gain by the increased number of pieces he could turn out, but a new schedule should be put into effect covering other workers on the same operation, and in the event of death, dismissal, or quitting of the worker who made the improvement, the old schedule would automatically be canceled."

"How would you organize for this work?" asked Phelps.

"I would organize a rate-setting department, under a competent supervisor, and have it co-ordinate in authority with the mechanical betterment department under Mr. Graves here, both departments to be known as the 'operation standards division' under an operation engineer. I would also recruit the study men from the ranks of the workmen, and use a stop-watch if the workers could be made to see its value and importance in setting permanent tasks."

After lunch a few days later, King, Bates, and Wilson were again seated together in the company yards. They felt quite pleased over the part they had played in the development of the plans for rewarding workers.

"We've got to hand it to you, King," said Wilson, "for you started this idea of our 'horning in' on wages, but we got in, helped, and the plan looks good to me."

"Yes," said Bates, "I guess we'll have the ham and eggs now."

(To be concluded.)

A Hard Job as a First Test

A UNIQUE plan is followed by the employment department of one of the leading drug manufacturing companies. When a man is to be taken on permanently, the employment manager almost always gives him a test job. This job is at the bottom of the ladder and is so hard that it either proves him good material for future promotion or gets rid of him at once.

The Endurance Test

The first thing to be found out before the company puts time and expense upon developing a new employee is whether he has endurance, determination, and energy. Therefore, the employment manager picks the hardest and sloppiest and most laborious job that is open. He explains beforehand to the man exactly the character of the job, that it is not easy, that it is not a white-collar or silk-cuff job. He prophesies to his face that the man will not stay on the job more than two days if he takes it. Therefore if the employment candidate accepts the job it is not under a delusion.

Many men do not, in fact, last out two days or even the first day. They depart in weariness or disgust. Some are scared off just by telling them the actual conditions of the job. The employment manager heaves a sigh but is, in a way, glad to see them go, for the company has not wasted constructive work on a poor foundation.

After a man works on this job for a few weeks and has done it well, the employment manager puts a new man in his place and sends him to another department. Here the work is lighter and easier. The man who has done the more difficult task can do the new work with more speed and more pleasure than if he came to it fresh from outside. Indeed the new work is such a relief that he now has time to use his brain as well as his determination.

It is understood throughout the factory that new employees have to start on hard jobs, and when they work faithfully they will be advanced to jobs where the working conditions are more and more pleasant. There is an informal but regular sequence from department to department, determined partly by pay and partly by working conditions.

A similar course is followed with girls and women. The cream of the girls' jobs in a drug factory is considered to be work in the perfume department—not because of the dreamy fragrance, but because packages are small and extremely neat, even decorative. This is "nice" work. Promotions, of course, must be made within a reasonable time. They must be frequent enough to give the desired effect of progress. A new girl can reach the perfume department in two years.

Good Results Obtained

A promotion sequence for unskilled labor in an industry where most of the processes have no sequential dependence on one another would seem to be an anomaly. But the method in use in this factory provides a psychological system of promotions which are just as effective as a more elaborate system in an organization of skilled mechanics, foremen and executives in the machine building industry.

The result is that the present employees know they, instead of outsiders, will have first choice of better jobs. They are contented and work with more confidence, energy, and ambition. New employees, confident of like treatment in the near future, work harder, and outside people are eager to join the stream of quick promotion in this factory.

Attraction for New Employees

In times when a labor shortage exists it pays a firm to have the reputation that this drug factory bears because the good men who are looking for a chance to prove their worth and get a job where they can advance are ready to come in and stick, once they make a start. Hard workers who receive fair treatment and quick promotion are the best kind of employees.

Lower-Cost Factory Power

How $9100 Per Year Was Saved Through Planning

By GEOFFREY C. BROWN

Chief Engineer, Jacques Kahn, Inc.

Class Number
658.26 Power Factor in Management
621.311(002) Power Production. Cost

MANY factories, with their production and cost features well under control, and with shop departments efficiently organized, neglect their power plants, careless of the fact that in this important department a large proportion of the annual operating outlay is absorbed. This is particularly true in the case of small factories with power plant capacities of 500 hp. or less, and these small factories, in point of number, have overwhelming ascendency over the larger ones.

This tendency to overlook the power plant is largely due to the position that it occupies in the perspective of the average manufacturing executive. Concerned with the planning of production, and with shop details, he mentally isolates his power plant, unconscious, apparently, of the fact that the principles which he applies daily to the planning and control of manufacture can be applied in pretty much the same way to the planning and control of power production, and with just as gratifying results.

A factory power plant may be simply visualized as a small factory operating within, and selling its product to a larger factory. Raw material in the form of fuel and water passes through definite operations in this small factory, emerging from the boilers or generators as a manufactured product, to be distributed, in this form, to various manufacturing departments—the small factory's clientele.

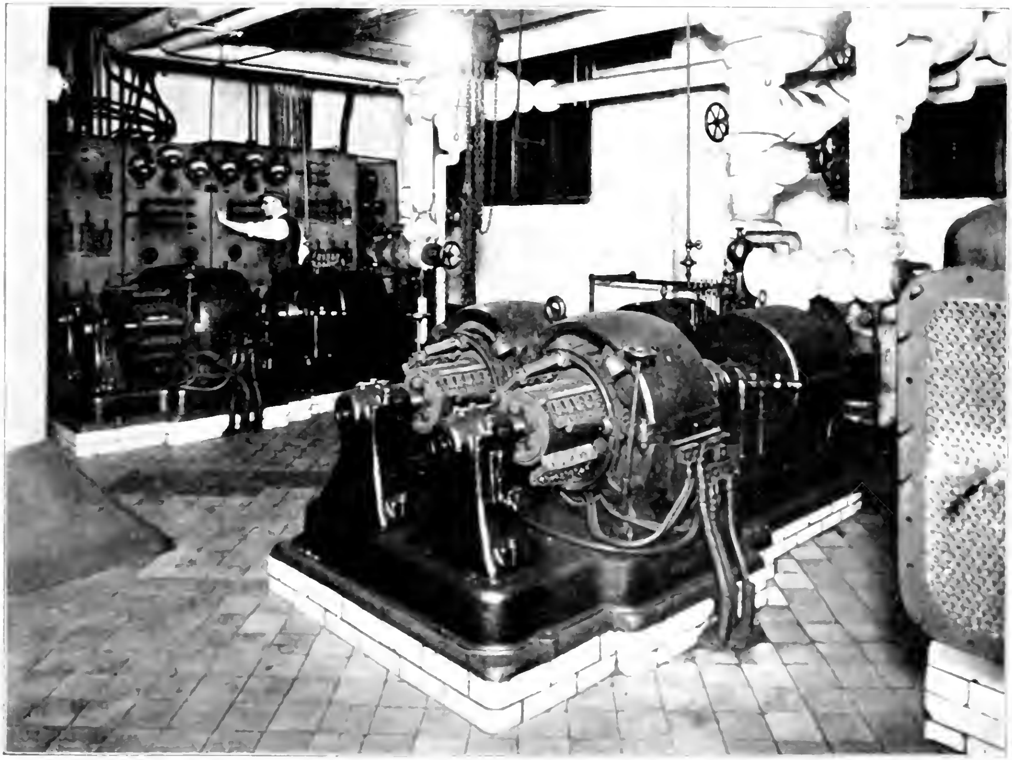


FIG. 1. VIEW OF ENGINE ROOM, JACQUES KAHN, INC., SHOWING TURBO GENERATORS AND POWER BOARD

FIG. 2. THE PLANNING OFFICE OF JACQUES KAHN, INC.

In order properly to conduct this small factory, raw material must be purchased, recorded, and efficiently stored. Necessary supplies such as lubricating oil or boiler compound must be purchased, recorded, and issued as required. In order that manufacture may be intelligently controlled, capacities and outputs of the manufacturing equipment—boilers and generators—must be metered and recorded; and so as to be sure that each customer is receiving as much of the product as he has ordered and will subsequently pay for, the amount sent to each must be measured. This small factory has its pay-roll. It must keep its equipment in repair, and pay rent for the floor-space that it occupies. Finally, each of its operations must be conducted efficiently and economically, and each day's performance at all stages carefully noted.

Seen thus, the planning of power production is similar in character to the planning of factory production, and is susceptible to the same controlling principles. Stores control must be exercised, output must be recorded and costs accurately determined and charted. With these features established, the economy of operation is readily gaged, and future policy determined.

An Instructive Case

What follows is a description of some actual results obtained in the past year, by application of these principles to the management of a small factory power plant. It has been my privilege during this period to have assisted in the reorganization of all departments of a New York mirror factory. A general account of this investigation and of its results, was published in MANAGEMENT ENGINEERING,[1] but the economies effected in the power department alone were of a striking character and seem to warrant a separate presentation.

The plant consisted of two 200 hp. Heine boilers supplying steam for two turbo-generators, each of the latter capable of developing 150 hp. (See Fig. 1). The boilers, in addition to providing live steam for the turbines and power plant auxiliaries, produced additional steam for use in various manufacturing processes. Exhaust steam from the turbines was utilized in winter for heating the factory, and in summer was wasted. The generators supplied electric power to factory motors, factory and office fans, elevators and electric lights, and the switchboard was wired in such a way as to permit switching over to New York Edison power should a breakdown, or some other contingency, occur.

The Original Condition

While the plant equipment was fairly adequate for the production of its quota of steam and electric power, the necessity for *managing* this department, in the modern significance of the term, had never been realized, and records which might have served as an indication of operating efficiency, were conspicuously absent. A calculation early in the investigation showed that approximately 15,000 lb. of steam were produced per 2500 lb. of coal burned—an evaporative efficiency of only 49 per cent. A crude weekly log report was maintained by the power plant engineer, showing the daily output of electric power from the generators without any record as to steam production. The amounts of live steam or electric power consumed by individual factory departments had never been either metered or estimated. The unit costs of electric power per kw-hr. or of steam per thousand lb., were not known, and while, due to coal shortage or occasional breakdowns, considerable amounts of New York Edison power were

[1] May 1923, p. 307.

used annually, no figures, providing a comparison between the cost of this purchased power and that produced by the factory generators, were in existence. Power plant supplies were purchased on a verbal request from the power plant engineer, and upon receipt, were handed over to him to be used at will, without record. No inventory of fuel or supplies had ever been maintained, and power plant costs were roughly visualized once a month by the coal transactions appearing on the company's general books.

It has been mentioned that this power plant investigation was incidental to a general reorganization of the entire factory. The fundamentals of a production planning system, including scheduling of output, balance of stores, and a cost department, had already been introduced, and the extension of the cost finding and balance of stores functions to the power plant seemed a logical procedure. A perpetual stores inventory kept in visible card-filing cabinets had just been installed in the main factory office, so a section of this was diverted to serve as a record of power plant raw materials and supplies; separate cards being provided showing balances and values of coal, water, lubricating oil, grease, boiler compound and repair parts. The indiscriminate purchase of power plant supplies without record was discontinued, these being controlled thenceforward by written requisitions from the power plant engineer to the planning office. (See Fig. 2.)

Power Plant "Balance of Stores" and "Weekly Plant Log Abstract"

It was necessary, also, that a regular report showing each day's power production, be received in the planning office, just as daily production records flow back from the manufacturing departments. This was accomplished by means of the "Weekly Plant Log Abstract"

Day	Light and Power Kw-Hr Tenant	Light and Power Kw-Hr Kahn	Light and Power Kw-Hr Edison	Water Cu Ft	Gas Cu Ft	Steam Lb	Coal Lb	Ashes Buckets	Evaporation Lb. Steam per Lb. of Coal
Monday	490	300	40	2,050	200	87,526.5	10,800	7	8.10
Tuesday	540	200	30	2,320	100	85,243.2	10,000	6	8.52
Wednesday	610	290	20	2,580		86,004.3	10,600	6	8.11
Thursday	590	310	20	2,640	200	87,526.5	10,200	5	8.58
Friday	520	310	20	2,660		79,408.1	9,800	6	8.10
Saturday	310	150	20	2,220	100	44,651.2	6,400	5	6.95
Totals.	3060	1650	150	14,470	600	470,359.8	57,800	35	8.14

100,000 Pounds Coal Received March 23
190,200 Pounds Coal Balance on hand.

FIG. 3. WEEKLY PLANT LOG ABSTRACT FORWARDED AT END OF EACH WEEK TO PLANNING OFFICE, BY POWER PLANT ENGINEER.

reproduced in Fig. 3. This report is a summary taken from the daily log report of the power plant engineer and forwarded weekly, by him, to the planning office. As will be noted, it shows in the form of daily and weekly totals, the kw hr. produced from the turbo generators, the kw hr. purchased, steam production in lb., cu. ft. of gas used, coal consumption, ash removal, and the daily evaporative ratio expressed in pounds of steam produced per pound of coal burned.

By using monthly totals taken from these reports, and applying unit costs per kw hr. for electric power, and per thousand lb. for steam, a tentative distribution of power costs to factory departments in proportion to the departmental floor space, was readily effected. This initial distribution was of a perfunctory character, and the actual quantities of electric power and live steam used by each factory department, are now being metered.

Evaporative Efficiency Increased by Use of Flow-Meters

Having established, in this way, an adequate system for the recording and distribution of power plant costs, it was necessary to concentrate on bringing the main producing units—the boilers—to the highest point of efficiency attainable under existing conditions. As no records which might have served as a clue to present or past evaporative efficiency were in existence, this had to be computed indirectly and somewhat perfunctorily, by proportioning the actual water evaporated over a considerable period of time, against the coal burned during the same period. This calculation established the fact that an approximate average of 6 lb. of steam per lb. of coal had been maintained, equivalent to an evaporative efficiency of 49 per cent—a very low average. The coal used during this period was of good quality, so the low efficiency ratio must needs be attributed to its uneconomical use, or in other words, to improper firing.

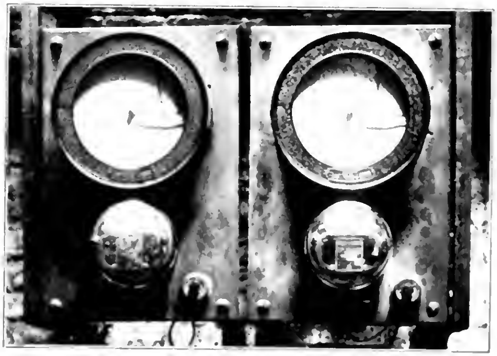


FIG. 4. REPUBLIC STEAM FLOW METERS IN BOILER ROOM

Walter N. Polakov, in an article appearing in the current number of *The American Labor Monthly*, makes the following somewhat startling statement. "The application of scientific methods to firing our boilers, can save some 150,000,000 tons of coal per year, now wasted shamelessly, for the want of such knowledge, by firemen in this country."

This appalling aggregate of wastage could be greatly reduced if, in all the power plants of the country, adequate steps were taken to instruct firemen in the economical use of coal. Boiler tests and lengthy computations of efficiency are of little avail if practical provision is not made for the maintenance of efficiency when it has finally been attained. Power plants should be equipped with recording meters of the Republic or Bailey types, which, visible at all times to the fireman, will tell him at a glance whether the ratios of his draft and steam are correct, so that he can regulate accordingly, either the amount of coal that he is feeding or the volume of draft that he is maintaining.

high and low sides. This indicates that the fireman during part of the time used an excess of draft, and for the balance of the period did not use enough. The other chart shows a marked improvement. During the four months that have elapsed, the fireman has learned how to feed coal at proper intervals and to adjust his drafts in such a way as to keep the pen-arm scribing on the zero line.

Readings of the Day's Production of Steam

In addition to the relation recorder, this equipment includes an indicator showing how much steam is being

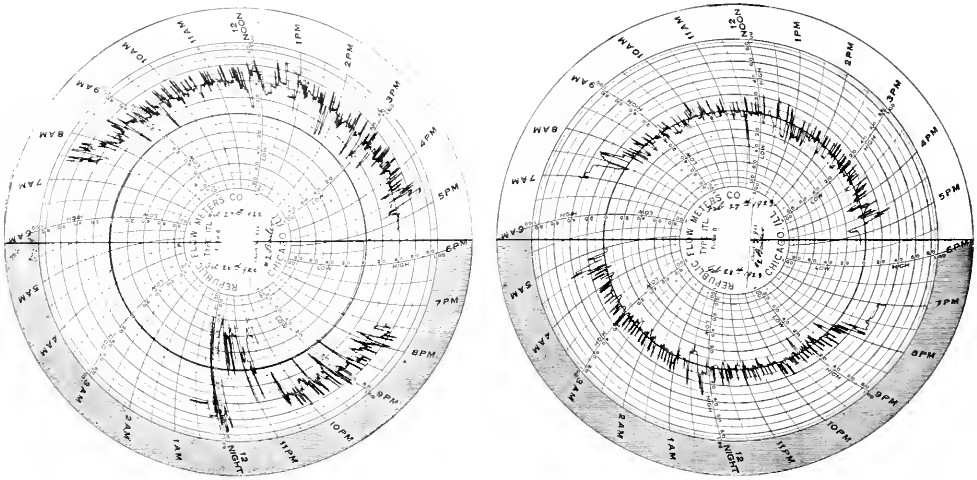


FIG. 5. TWO ACTUAL REPUBLIC FLOW-METER CHARTS

Chart on left shows improper firing with curve away from zero line. Chart on right, four months later, with curve consistently on zero line, indicates proper firing and efficient combustion.

Realizing the need of such control, arrangements were made, for the installation of Republic flow-meter equipment recording from each of the two boilers. This instrument, Fig. 4, indicates by means of a recording chart, the exact relation between the volume of draft and the volume of steam produced. The fireman is thus provided with a directly graduated relation recorder so constructed that when the ratio of air to the steam produced is correct, the recorder will read at zero. If, for any reason, the air supply is insufficient, this will so record; and if the air is in excess, this in turn is recorded, so that a definite record, showing just how nearly the fireman approaches the correct condition, is always available.

Economical Firing

Two such charts taken from our back files, and each indicating two days of actual operation during the investigation, are reproduced in Fig. 5. The chart at the left, for October 27 and 28, 1922, shows improper firing with the curve away from the zero line on both

produced at any given moment, and an integrator which totalizes, so that at the end of each day a record is provided of the total steam generated from each boiler. These readings can be taken each evening to be entered on the power plant log as the day's production of steam. By the continued use of these charts, we were able to advance in the short space of two months from a calculated evaporation of 49 per cent, to an actual efficiency of 65 per cent, an increase of 32 per cent on the basis of the former figure.

Produced Versus Purchased Power

The final stage of the investigation should prove of interest to many concerns which, while operating small power plants, are in a state of doubt as to whether it would not be cheaper to discontinue the production of electric power and run entirely on purchased power.

Early in the investigation, it was established that the pivotal feature lay in the availability for use, of the exhaust steam from the plant turbines. In other words, if there was use for all, or an appreciable part of the exhaust steam, it was economical to operate the electric plant; while if the exhaust steam went to waste through unavailability, it was more economical to shut down the generators and run on purchased power. This conclusion was based on a scrutiny of power consumption and costs during the years 1921 and 1922, and took full cognizance of the quantities of live steam required independently for manufacturing purposes.

During the winter months (October 1 to May 1), 480,000 lb. monthly of exhaust steam was available for heating the factory, as a by-product from the turbo-generators. When the value of this steam, plus the cost

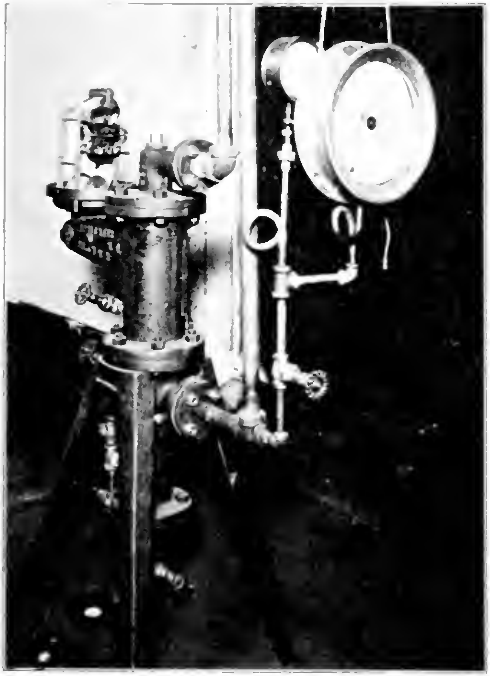


FIG. 6. ST. JOHN'S DIRECT STEAM-FLOW METER
Used in measuring quantities of steam sent to individual factory departments.

of producing 870,000 lb. monthly of live steam for manufacturing processes, was subtracted from the total cost, the cost per kw-hr. of producing power at the generators became 3.9 cents.

In summer when the necessity for steam heat disappeared, and the exhaust steam was therefore unavailable, this figure became 7.3 cents per kw-hr. The average cost for the entire year on this basis was therefore 5.3 cents per kw-hr.

In making a comparison with the New York Edison Company, the following items must be added to the Edison unit cost.

Cents per kw-hr.

(*a*) Surcharge based on the present coal price........ 0.5
(*b*) Unit cost covering power plant wages, rent, depreciation, insurance and taxes which would be constant on either basis........................ 0.9
(*c*) In winter, the cost of 480,000 lb. of live steam monthly, which must be produced to heat the building in place of that amount of exhaust steam available at no added expense when operating the plant generators 1.7

This gave a summer cost of 5.8 cents and a winter cost of 7.5 cents per kw-hr., equivalent to an average unit cost per year of 6.7 cents, or 1.4 cents per kw-hr. higher than if all the electric power were produced from the plant generators.

It was finally established, that the most economical basis was provided by operating entirely from the plant generators during the heating period (October 1 to May 1), and operating entirely on purchased power during the five months of non-heating. The winter cost on this basis is 3.9 cents, and the summer cost 5.8 cents, *making an average cost for the year of 4.7 cents per kw-hr.*

Comparison of Power Costs

During the year 1921, the total consumption of electric power was 244,920 kw-hr. of which 211,920 kw-hr. was produced from the plant generators and 33,630 kw-hr. was purchased from the New York Edison Company. The cost of this power was $14,977.31. In the following year (1922) owing to the accident of a coal shortage, considerably more Edison power was used during the summer months, the total consumption being 252,430 kw-hr., of which 168,300 kw-hr. was produced by the plant generators, and 84,130 kw-hr. was purchased. The cost of this power was $12,259.73. A tabulation of these figures is as follows:

YEAR	ELECTRIC POWER PRODUCED KW-HR.	ELECTRIC POWER PURCHASED (EDISON) KW-HR.	TOTAL ELECTRIC POWER CONSUMPTION KW-HR.	TOTAL COST
1921	211,290	33,630	244,920	$14,977.31
1922	168,300	84,130	252,430	12,259.93

By an accidental increase in the use of purchased power during the summer of 1922, $2700 less was actually paid for a greater amount of current than was used in the previous year.

This conclusion was verified by a comparison of operating expenses during an actual year, with an estimate of what this expense would have been if purchased power had been used exclusively during the non-heating months. This comparison is shown by the Table 1.

The conclusive character of these figures led to immediate arrangement for the shutting down of the plant generators on April 30, of the present year. The factory now operates exclusively on central station power, and will do so until October 1. To provide live steam for manufacturing processes during this period, one of the two boilers is being operated at reduced pressure. After the first of October and until May 1924, electric power will be produced entirely from the plant generators, with a nominal amount of New York Edison power held in reserve in case of breakdown.

TABLE I. COMPARISON OF POWER COSTS

Actual Method of Operation

Coal—1649 tons	$15,370
Ash removal	674
Water	120
Labor	5,320
Supplies and repairs	1,722
Purchased electric power	2,794
Total	$26,000

If Purchased Power Had Been Used During Non-Heating Months

Coal—1018 tons	$ 9,200
Ash removal	408
Water	45
Labor	4,550
Supplies and repairs	850
Purchased electric power	7,050
Total	$22,103

gives an aggregate saving of $9100 annually, an amount equal to 35 per cent of the total power plant cost during 1922.

While these results are satisfactory, and a source of encouragement, they are subordinate in a sense, to the important general result—the fact that the power plant has been placed under a régime of centralized control, just as definite as that exercised in planning production through the factory. In the second paragraph of this article, I referred to a tendency on the part of manufacturing executives to overlook the power department, ascribing this to a certain isolation which the plant commonly has according to their points of view. By bringing the power plant within the jurisdiction of our newly organized planning department, we overcame this tendency. The changes effected were more changes in methods of management than in methods of operating, and with the exception of some recording meters, no new equipment was added. Stores control was instituted, costs were determined, and output at all stages carefully recorded. With these features established, the general economy of operation was rapidly gaged. The specific economies described, followed as a logical sequence.

The installation of St. John's Steam Flow-Meters (Fig. 6), and watt-hr. meters for the purpose of measuring the actual amounts of process steam and electric power used by each factory department, is an important result of the investigation. Portable meters loaned by the New York Edison Company are at present in use, but there is every indication that permanent equipment will eventually be installed. Estimated figures are subject to inaccuracy from a variety of causes, chief among these the fact that in preparing the estimate, conditions are assumed as constant which may not be so. Power demands from factory departments fluctuate from hour to hour, irregularly and sometimes within wide limits. Estimated figures on consumption necessarily ignore these fluctuations, and render the final distribution of power costs proportionately erroneous.

The economies resulting from this study are now in process of realization. The increase in evaporative efficiency following the installation of Republic flow-meters in the boiler-room may be conservatively cited at 30 per cent. This is equivalent to an annual economy of $6100 in power plant expense, on the basis of former practice. By shutting down the plant generators during the non-heating summer months an additional yearly saving of $3000 is being effected. This

FIG. 7. VIEW OF ENGINE ROOM, JACQUES KAHN, INC., SHOWING FEEDWATER PUMPS AND FEEDWATER HEATER

Grading the Office Job

V Adapting the Scale to Other Lines of Business

By FORREST A. KINGSBURY

Assistant Professor of Psychology, University of Chicago

ANY office executive who has followed, in the earlier articles of this series,[1] the discussion of the job-grading problem and the method by which it was solved in two large banking institutions, has doubtless said to himself: "Yes, but is this applicable to *our* line of business? Suppose we should attempt to grade the jobs in our office in order to make the salary schedule fit the importance of the jobs, wouldn't we need to have a grading scale suited, not to a bank, but to our business? And if so, how could we construct our own scale and be certain it is sound?"

It is the purpose of this, the concluding article of the series, to answer this question. Certainly, as has been pointed out before, no one should attempt to carry over *uncritically* the grading scale which has been described, and use it in a different kind of business. He should first determine how well it is adapted to his business, and make such changes as will render it suitable. How extensive such changes would have to be, the writer will not attempt to say. Every different kind of business offers its own peculiar conditions which may render more significant any of the several factors in the scale. It is at least open to question, for example, whether other lines of business would find it desirable to give as much weight as a bank to personal contacts with the public and the related personal qualities—courtesy, good appearance—or to responsibility for money and securities.

> **IS IT adapted to *our* line of business?**
>
> **Professor Kingsbury's articles describe his procedure in grading the "jobs" of two large institutions—this for the purpose of salary revision and to guard against wastefulness and general inefficiency. In the present article the author describes the modifications necessary to adapt his job-grading procedure to other lines of business.**

Procedure in Job-Grading

At the same time, when we compare bank clerical work with other kinds of office work, we find that they have more points of similarity than of difference. It seems clear, therefore, that the general method, at least, can be carried over to other fields. The same procedure by which the original scale was devised and its validity determined can be followed in any sort of office. This article, therefore, will answer our central question by describing how the bank job-grading scale was constructed and its validity tested, and by suggesting how this procedure should be followed or modified in other situations.

The main steps in any job-grading program may, for convenience, be summarized as follows:

1. Prepare job-analysis form for obtaining information about each job to be graded.
2. Enlist the fullest co-operation of those employees and executives whose assistance, either in getting the information or in putting into effect the final program, is desired.
3. Get detailed job descriptions from all available resources.
4. Review and check this job information to insure accurate data and reliable estimates (where estimates are necessary).
5. Tabulate on summary grading sheets all job facts which seem worthy of further investigation.
6. Select and assign weight to the job-factors which are to be included in the grading scale.
7. Test the validity of the provisional gradings of all jobs (or a large number of jobs) as made with this scale, by comparison with all available standards, and make all necessary revisions in the scale, both the factors and the weightings.
8. Make the final grading of each job in accordance with the revised scale, and transcribe these gradings to individual job-specification and grading sheets.

If salary revision is contemplated, steps 9, 10 and 11 must also be taken.

9. Prepare grade index salary comparison chart to determine normal salary range for each job.
10. Get efficiency ratings of individual workers and any other personal records desired.
11. Determine, on the basis of efficiency ratings, experience, and any other personal facts which should be taken into account, the individual salary differentials within the normal salary range.
12. Provide a program and machinery for periodical review and (wherever necessary) revisions of the job gradings, and for periodical efficiency ratings of each worker; and take the necessary steps for putting salary revisions and program into operation.

[1] *Administration* for March, April, May, and June, 1923.

Our present concern is with steps 5, 6, and 7, since all the others, except step 10, have been described in detail previously. The problem of getting reliable efficiency ratings of individual employees, mentioned in steps 10 and 12, has received much attention in the recent literature on personnel administration; but since rating *employees* is a problem distinct from, although intimately related to, the present problem of grading *jobs*, we shall omit further discussion of it in this series of articles.

General Method of Attack

The questions, then, before us for answer may be stated as follows:

1. How shall we decide what factors to include in the scale?
2. How shall each of these be weighted?
3. How shall the validity of each of these job-differentiating factors be measured?

For reasons which will become clearer as we go on, these three questions cannot be taken up separately and answered in order. They are, after all, simply different sides of one complex question, which is that of testing and retaining or eliminating various suggested factors and various suggested weightings, in order to obtain a list of factors and weights which shall accurately differentiate job grades.

For various reasons, the method known as "partial correlation" which is sometimes used in weighting the elements that contribute to a complex series of measurements is not practicable here. Hence, our method must be to test each factor and each scheme of weighting separately by our constant standard—that of its efficacy in making consistent grade-differentiations; to retain, at least for further test, those which seem to be valid; and to reject those which are not promising, until we reach, empirically, a combination of factors and weights which proves, by all standards, a sound one.

Such a process of "trial and error" is not unscientific. On the contrary, it is the accepted method by which scientific experiment proceeds—the accumulation of facts bearing on a problem, the setting up of hypothetical solutions, and testing of these hypotheses experimentally. No keenness of psychological or economic analysis can dispense with the necessity for the constant testing, trying out, and revising of each suggestion. The "hunch," which is merely a less dignified name for the "hypothesis," is an indispensable part of scientific research, but only if each hunch is subjected to critical test.

Selecting Job-Differentiating Factors

Where, then, shall we go for "hunches" as to which factors to try out? The answer is, to our job analysis data. The adequacy of our job descriptions for offering suggestions worth investigating will depend to a considerable extent on the ingenuity with which we have prepared the job analysis forms or questionnaires so as to bring to light all significant features of each job. It will depend also on the alertness with which we search the job descriptions for other promising leads. A desirable procedure is to read many job descriptions and to make a memorandum of everything that suggests itself as a possibility worth considering.

The convenience of the summary grading sheet for displaying these facts and facilitating their evaluation has been described.[2] Enough columns should be provided for the recording of all details which seem worth considering. When a provisional factor or a scheme of weighting proves futile, it can be erased or changed until the scale in its final form and the weightings based thereon are all that remain.

In addition to our standard principle of selecting—the efficacy of the factor for differentiating higher- from lower-grade jobs—we can at once set up three other selective principles which will limit the range of our investigation. Job factors, to warrant inclusion in even a tentative job-grading scale, must meet these requirements:

1. They must be relevant to *all* jobs, not merely to a few.
2. They must be clearly *discoverable* and *definable*, not dependent on unverifiable opinion, either of employee, manager, or investigator.
3. They must be *quantitatively* describable.

Consideration of Job-Differentiating Factors

Let us consider each of these a little more specifically:

1. Certain qualifications will be important in some directions but not important so far as differentiation between lower- and higher-grade jobs *in general* go. The degree of skill in machine operation—such as typewriter or adding- or billing-machine operation—required by a bank job is of this sort. Some jobs require higher skill than others. But it is undesirable to make this a factor in the grading scale, since it pertains only to a part of the jobs in the institution and not at all to others. As a rule, material advancement in a bank does not depend on it. If one advances from a machine-operator's job to a superior position, it is because of the revelation of personal qualities or abilities other than this, and in an executive or semiexecutive position he may never be called on again to use this particular skill. Where, however, the special training that has gone into the acquisition of this skill does seem to merit additional compensation (as for the stenographers) it may receive weight under "special training." A scale factor, then, must be a *common* factor.

2. Job factors must be *objective*, so far as possible. As was pointed out in the first article of this series,[3] it does not seem possible or desirable to eliminate entirely the element of personal opinion. But a distinction should be made between those opinions which are *mere* opinions—the "I can't explain why I believe this but I do" sort of thing—and those which are estimates based on definite, describable facts, upon which experienced executives substantially agree and in which they have sufficient confidence to base important actions. The former should be ruled out. The latter are at least worthy of consideration.

As example of factors, significant but proving too

[2] See *Administration*, June 1923.

[3] See *Administration*, March 1923, p. 271.

subjective in character to warrant retention in the bank job-grading scale, are "Instruction Period"—length of time ordinarily required to teach a beginner the duties of the job—and "Probation Period"—length of time ordinarily required before new employees can work without frequent supervision. While both of these were included in the provisional forms of the scale, it was found that managers varied so greatly in their estimates that neither could be taken as wholly reliable. "Instruction" often takes place by an "understudying" process, supplemented by assistance and advice at odd moments over a considerable period of time, so that any time estimate can be little better than a guess. "Probation" estimates are likewise highly speculative. Both, moreover, vary widely with the ability and previous experience of the individual being trained, so it is hard for the manager to know what "ordinarily" really means. Hence, both these factors were omitted from the final form of the scale.

3. To be included in a numerical scale, job requirements must be describable in quantitative terms. If the factor is objective in character this is usually not hard to do. "Yes" or "No" answers are ordinarily weighted 0 or 1, but several definable degrees are preferable, and in many factors absolutely essential. This necessitates the careful formulation and testing of a set of definitions for various weightings, as described in the third article of this series.[4]

Testing Factors and Weights

After we have enumerated those job facts which are worth testing for their right to inclusion in the grading scale, we proceed to two problems:

1. The discovery of those factors which consistently differentiate the higher-grade from the lower-grade jobs.
2. The determination of the range of weights to be assigned to each and the formulation of definitions for each degree of weight.

These two problems cannot be solved independently of one another. Neither can they be taken up successively. The validity of both factors and weightings must be established *progressively*, partly as the work proceeds and necessary changes become apparent; partly after all jobs are graded and the scale can be evaluated as a whole. The discovery and elimination of the non-differentiating factors inevitably leads to the question: "Are those that remain all equally significant, or must some be weighted more heavily than others?" The same kinds of calculation that solve the one will also help to solve the other.

As the investigation proceeds, it will appear that certain factors will have to be redefined, in order to allow for weighting more heavily those which characterize most emphatically the higher-grade jobs. After each modification of this sort it becomes necessary, of course, to recalculate all grade-indexes by the new list of factors and weights. Ordinarily the gross inaccuracies will become apparent early in the game. Jobs known to be high-grade which do not show a markedly high grade-index in comparison with others will point to the need of revised weightings. Where several such cases appear, comparison between them will usually reveal the underweighted factor. For example, the earliest scale used in the bank analyses described in these articles provided only 3 points weight for the maximum amount of experience, and 2 points weight for the greatest executive responsibility. It became evident before many jobs had been graded not only that these weights did not permit certain jobs to be graded high enough, but about how much they would have to be increased. Revised weights and definitions, providing for as many as 6 points on executive responsibility and as many as 7 points on experience were therefore prepared. Responsibility for money, which it seemed at first might be omitted, soon proved to be so specifically and so significantly a requirement for certain of the more important jobs, that a series of definitions were prepared, providing for from 1 to 4 points weight on this factor.

On the other hand, job conditions and requirements that at first seemed worthy of examination proved on test not to be differentiating factors. "Stress of work" (i.e., whether or not the work is done under pressure to meet an externally imposed schedule) was found to characterize lower-grade jobs about as often as higher-grade jobs. "Public contacts through work" was not a high-grade requirement, being descriptive of the work of stenographers, typists, addressers, and mail department advice-clerks as well as of correspondents. "Woman required" appeared oftener in the simple, clerical jobs than in those of higher responsibility. Many personal qualities were found to be called for either in practically all jobs, or equally often in lower-grade and higher-grade jobs. These, therefore, had no place in the scale.

Evaluation Standards—Salaries—Rank

It will be clear that all this testing implies that we already have a basis of some kind for distinguishing lower-grade from higher-grade jobs, aside from the grading scale itself. We *must* have such a basis in order to determine whether our scale does what we wish. A scale whose validity at any stage or in any detail cannot thus be checked against some existing standard would be worthless.

Several such standards can be formulated. Salaries now paid offer a rough indication of the relative importance of a job. But since salary-revision may be the primary object of such a job-grading program, it seems best to disregard present salaries entirely and this accordingly was done in the investigations described.

The importance of the job in comparison with others, as estimated by the departmental manager or other executive affords another standard of comparison. In a small office it may be possible for one executive or a small group of executives to know enough about the details of every job in the organization to place them with a good deal of reliability in certain previously designated levels. But in an organization where em-

[4] See *Administration*, May 1923.

ployees number several hundred or several thousand, particularly where duties are highly varied, involving perhaps scores or hundreds of details in single jobs, this becomes a very difficult problem. In such cases it has proved feasible to have the jobs within a single department ranked in the order of their importance by the manager and also by the chief clerk of the institution, so far as his familiarity with the jobs enables him to do so, and then make interdepartmental adjustments later.

In any department, the mere ranked order of jobs will of course give no indication of the relative amount of difference between jobs. This latter is the problem of the scale. The consequent limitation of the rankings must be constantly kept in mind. Discrepancies between grade-index order and rank-estimate order are not so serious when comparing two approximately equal clerical jobs as they would be if occurring between a minor clerical job in a small department and an executive job ranking next above it. But if the scale can be made to yield gradings corresponding in order to job-rankings inside *all* departments especially on jobs of nearly equal grade, it is quite certain to place jobs of different departments in correct order and to indicate fairly accurately relative amounts of difference.

Evaluation Standards—Promotions—Analysis Data

Still another standard of comparison is the record of lines of promotion, either as practiced in the past or as judged possible by those in charge of promotions. Usually this sequence is in accord with the estimated rank of jobs in the department. In about nine departments out of ten in the bank analysis the job-rankings, promotion-lines, and grade-index lists substantially duplicated one another. But the promotion sequence often affords in addition some indication of the amount of difference between successive jobs, since promotion implies an advancement through a recognizable yet somewhat limited degree. The promotion sequence also may afford a basis for comparing jobs in different but related departments, between which transfers are frequent. It is particularly useful where personal success records are available for individuals who have been promoted in the past, indicating whether or not the promotion sequence is a practicable one.

The job analysis itself offers internal evidences of grade-differences which are significant. Such job-requirements as age, experience, and amount of responsibility serve as a check on other factors, since they need no extended investigation to prove that they are indicative of job-importance. They do not, of course, serve as exact indexes of job importance, but they do operate as important secondary indicators.

Not all of these standards will agree in detail with one another, particularly if in a given department there be several jobs of almost equal importance. But taken together, they afford a reliable basis for determining whether or not the scale does yield grade-indexes which are accurate indicators of job importance within each department. Where the scale is proved sound for all departments separately, it is almost certain to be valid for the organization as a whole, although all available interdepartmental standards should be applied to the grade-indexes to insure their reliability. Similar or "standardized" jobs in different departments, such as office boy, stenographer, or typist, afford a basis for equating gradings interdepartmentally.

Where there are inconsistencies between the job-rankings based on the various standards and the grade-indexes as computed by the scale, they point to one of three possible sources of error. Intensive examination will reveal which is at fault:

1. The *scale* may be imperfect. If so, there will probably be ample corroborative evidence from other jobs and other departments. In this case, a comparison of those jobs which are "out of line" is likely to reveal promptly the point where the scale is at fault—some factor wrongly included, some significant factor omitted, or some factor incorrectly weighted. This of course calls for a revision of the scale and the definitions and a recalculation of the grade-indexes until the inconsistencies disappear or are proved to be not chargeable to the scale.

2. The job *data* may have been wrongly reported. Further detailed inquiry about the job which is out of line is likely to reveal this and lead to its correction and thus the correction of its grading.

3. The standards of comparison are not infrequently mistaken. The manager may rank a job incorrectly for any of several reasons. He may temporarily overlook certain significant facts about the job. He may have in mind the incumbent instead of the job. He may fail to see that certain promotion lines are possible, or that certain past promotion practices are not truly representative of present conditions. But in one way or another, closer scrutiny is quite certain to indicate the method by which any inconsistencies between grade-index and other standards should be removed.

Methods of Checking Validity

Given a set of provisional gradings, and standards by which their validity can be tested, the proper procedure for doing this testing will be easily determined. Few complex statistical computations will ordinarily be necessary. The practicable methods may be grouped under three headings:

1. Simple inspection will—particularly after one has gained some familiarity with the problems and the facts—serve to answer the question in a good many cases. Where a set of provisional grade-indexes does not measurably conform to the rank-estimates or the promotion sequence, it is a clear indication of gross errors. Further inspection of the details of the grading will usually reveal the sources of the discrepancy. If such factors as minimum age required, experience necessary, or executive (or other) responsibility involved have been properly weighted, the fault will clearly lie elsewhere. If they have not been properly weighted, there will be too little, or too great, or too inconstant differences between the higher and lower jobs as compared with the differences between jobs known to be of approximately equal grade. If the jobs have been listed on the summary grading sheet in the order of their

estimated importance, a mere glance will show those points where low-grade jobs are being overweighted or the higher-grade jobs underweighted. Inspection will also reveal those points where the standards, such as rank-estimate or promotion sequence, are inconsistent with one another. No rules can be laid down in advance for making such inspection. What things should be done will suggest themselves after the facts have been spread before the investigator, and as he proceeds to dig into the problem.

2. A second device, particularly useful in testing those factors which are weighted either 1 or 0, is to compute the average of the provisional grade-indexes of all jobs weighted 1 on this factor and the average of those weighted 0. If the former average is not appreciably higher than the latter, it indicates that the factor is not one which consistently characterizes the higher-grade jobs.

This assumes, of course, that the provisional grade-indexes used represent at least an approximation to the final order. If one uses good judgment in his first selection and weighting of factors, his provisional scale is very likely to afford such an approximation. The next step will be to correct the gross inaccuracies in the factors and the weightings. Finally, after all jobs have been graded, the task will be that of evaluating the scale as a whole, and making the more minute changes in scale, data, or standards, which will bring grade-indexes into conformity with the standards.

3. On those factors which are weighted in several degrees, such as age, experience, education, executive responsibility, or money responsibility, one can, if he desires, use a more complicated statistical device; that is, he can compute the coefficient of correlation between the weighting of this factor on a number of jobs and their grade-indexes. As was mentioned in an earlier article,[5] in which its significance was discussed, the coefficient of correlation between the minimum age requirements of some sixty clerical jobs and their provisional grade-indexes was found to be about $+0.80$, which indicates that the minimum age requirement is a very significant factor in determining the grade of a job. Space will not permit the description here of methods of computing the coefficient of correlation or the interpretation of the coefficient, which are discussed in every book on statistical method. But it may be remarked that usually one can estimate the value of a given factor—especially after some practice—about as reliably by careful inspection or by the calculation of a few averages, as he can by the computation of the coefficient of correlation.

Improvements in the Scale

It would be as unwise as it is erroneous to claim that the scale as described in these articles is perfect, even for the type of business for which it was devised. The only claim that is made for it is that the scale enables us to do, with satisfactory accuracy, what has not been done before, and what, it seems, would be extremely difficult if not impossible to do without the aid of some such device. But it is possible that the same results might be accomplished more quickly, more easily, and more accurately if the scale were improved in certain details. It would be surprising, indeed, if this were not so. Every new device has to pass through a prolonged period of experimental modification before it attains its maximum efficiency. It may not, therefore, be amiss to mention a few points in which the makers of the scale believe that improvements might be made, in order that others who adopt the method may profit by their experience and judgment.

The constant effort has been to make the scale wholly objective in character, and to reduce to a minimum the factor of personal opinion; although, as has been repeatedly pointed out, it is impossible and undesirable to attempt to eliminate this factor entirely from such investigations. It is possible, however, to reduce the variability of judgment of different individuals who are called upon to state their estimates or opinions on the job-analysis questionnaires and to reduce the time and effort necessary to bring those opinions to a status of reliability. The "personal qualities required" constitute such a possible point of improvement. The participants in these investigations who discussed fully with one another the meaning and necessity of each of the personal qualities named, came readily to complete agreement on them; indeed, they found it possible to define the various degrees of these qualities with considerable precision; so the weightings of these qualities represent as reliable factors as any. But those who did not have special training or practice in this line varied materially in their opinions about the need, for given jobs, of various personal qualities, and to carry on conferences until agreement had been reached would have been impracticable. These necessitated, as has been shown,[6] careful revision of managers' opinions on these qualities.

Suggestions for Improving Scale

It would seem that this variability can be corrected to some extent by transferring to other parts of the scale certain facts implied in these quality-names. For example, "courtesy" and "good appearance" are mainly necessary because of contacts with the public or with officers. To define these qualities and to simplify the scale, these two factors and that of "personal contacts with public" might conceivably be combined in one, with four degrees of weight, which, taking a scale for banking jobs as an example, might be defined somewhat as follows:

Weight 0. No public contacts involved.

Weight 1. (a) Main floor job, where employee is seen by public.
(b) Frequent contacts with senior officers of bank involved.

Weight 2. Job involving frequent contacts with public; good appearance, courtesy, and tact desirable.

Weight 3. Positions in which customers form their opinions of the bank largely through demeanor or appearance of employee, and where good appearance, dress, courtesy, voice, and tactfulness are major considerations.

[5] See *Administration*, May 1923, p. 543.

[6] *Administration*, April 1923, p. 399

In a similar way such qualities as "judgment" and "adaptability" might be absorbed into the "minimum general intelligence required" factor, and the definitions pertaining thereto revised and extended to provide additional weighting for more exacting demands in these directions. It is also highly desirable by the way, that these degrees of general intelligence should be defined in terms of some standard intelligence scale, such as the Army Alpha. To do this would, of course, necessitate extensive preliminary investigation by means of tests and success ratings of employees, as well as with the job-grading scale.

"Executive responsibility" affords another place into which several personal qualities might be absorbed, including "judgment," "adaptability," "initiative," "vitality," "perseverance," and, of course, "directing ability."

Still another, and probably a better disposition of the qualities of "initiative" and "perseverance" would be into an expanded and revised set of definitions for "grade of duties." It seems likely that more than three grades could readily be defined, by taking into account such facts as the number of different duties, the variability of conditions and materials within each, the completeness with which each operation is covered by rules, the frequency of occasions for exercise of individual judgment, the frequency of appearance of difficult problems demanding unusual perseverance, and other differentiating factors which will readily suggest themselves when one reads over a large number of job descriptions.[7]

Definition of Special Training Courses

Finally, as has been suggested, it is desirable to define in more exact terms the various degrees of the factor of "special training courses," or "technical knowledge or skill," or whatever one may prefer to call it. While the practice followed in the two bank investigations yielded results which were generally satisfactory, they might be less satisfactory in other situations. Such revised weightings should take into consideration, at least provisionally, the length of time required to achieve such special training or ability, the prerequisite educational requirement for such training course, whether or not such ability can be acquired on the job or must be gained in a special institution, and perhaps other facts.

Adaptability of Job-Grading Scale

Whether it will ever be possible to construct a perfectly objective job-grading scale which will be equally well suited to every kind of office work, whatever the nature of the business and whatever the size of the organization, can be determined only after the method has been extensively used and the results made comparable. As to the size of the organization, there is *a priori* reason to believe, and some *a posteriori* evidence to support it, that the value of the scale which has been described is not rigidly limited to larger banks. The larger the bank the larger will be the proportion of lower-grade, routine jobs. The smaller the bank, the more widely will duties offering diversity of detail and involving responsibilities be distributed and the higher will be the average grading. Salary distributions—making allowances for differences in local practice—tend to correspond.

Such evidence as can be drawn from the comparison of the relative sizes of the two banks investigated with the general run of the gradings is in accord with this, as is also the informal acquaintance of the investigators with the work of small banks. This would seem to indicate that size is not necessarily a bar to the validity of the gradings. Nevertheless, the precise size-limitations to the usefulness of the scale remain to be discovered.

A Program to Meet Conditions

It is only fair to say, however, that the smaller the office or bank, and the more intimate the acquaintance of the executives with the details of the jobs and the personnel of the staff, the less crucial is the need for an objective, quantitative job-grading scale. But large-scale staff organization presents problems comparatively unknown to the small office. In large offices, the necessity for objective, impartial, quantitative personnel investigations and records, both concerning jobs and workers, becomes imperative if wastefulness and inefficiency are not to creep in. Every year sees a more general recognition of this fact, and greater concern about the discovery of adequate methods for meeting the situations. Such a program as we have described, modified in details to fit conditions, offers an approach to the solution of one important phase of this problem, the efficacy of which, it seems not too much to say, has definitely been demonstrated.

[7] Dr. M. A. Bills, in an article entitled "Job Classification and Personnel Rating" in *The Journal of Personnel Research* for December-January, 1922-1923, suggests ways in which additional weightings of "grade of duties" may be introduced.

Encouraging Employees to Become Home-Builders

MORE employees would build homes if they knew how to finance them. Home owners are happy, desirable employees; progressive, and good candidates for promotion. But many workmen are not acquainted with even the simplest methods of finance.

The assistant treasurer of the Greenfield Tap and Die Corporation is passing on to the body of employees the knowledge he has gained in his profession on how to finance the building of homes. He considered that it would be a shame if the lessons he had learned were not made useful to others in the company.

Using the shop paper as a teaching medium, he wrote a series of short articles on home founding. The first article outlined easy plans for financing the home. The second took up the buying of land and the choice of architectural plans to suit the pocketbook and the domestic needs of the owner. The third showed how a little activity before and after work hours could be made gradually but surely to build up the appearance of the home, and add to its value and pleasantness.

How to Keep Magazine Articles and Find Them

Indexing System of MANAGEMENT AND ADMINISTRATION

By HARRISON W. CRAVER

Director, United Engineering Societies Library

AMONG the minor problems with which every industrial executive has had to struggle is the indexing and filing of articles or clippings from magazines and pamphlets, reports and similar printed matter. This material tends to accumulate in the executive office, and often becomes a source of irritation either because it is disorderly in appearance or because the desired article cannot be found when it is wanted. The same problem faces the one who is in charge of the plant library, but there the problem becomes a major one.

Everyone who has had anything to do with such a collection of literature has wished for some system of classification which would bring similar material together into groups small enough for convenient examination and use. The real need is for some uniform, generally accepted system which can be maintained and used with a minimum amount of effort and expert knowledge.

It may seem that this problem is simple and one that should be solved with little difficulty. However, many have learned by experience that it is hard to hit upon a system which will expand to meet new needs as they arise, and at the same time prove adequate for the treatment of large amounts of matter without becoming burdensome in any of its aspects. A file of data of this kind is, after all, a convenience rather than a necessity; it is a useful working tool if it is really usable. However, it is economically unjustifiable unless it can be kept with less expense than would be entailed in obtaining the same information from other sources.

An Unlimited Number of Systems

Librarians to whom the classification of literature has always been a directly practical problem, have for generations been devising schemes and systems. Throughout their numerous experiments they have tried to secure as logical a classification as possible with a notation that would be simple, economical, and flexible, providing at the same time for the insertion of new subjects at any point whenever necessary. Unfortunately some of these desires are mutually contradictory. For this reason no general agreement has been possible as to the merits of various systems, for individual opinions differ concerning the relative importance of the desirable qualities.

As a result of all this work several systems have found general favor during the past 30 years and have been more or less widely adopted. Of all of these the decimal classification has undoubtedly been most widely used and found the greatest favor.

Class Number

025.4 Classification
029.3 Clippings

The decimal classification was published by Melvil Dewey in 1876 in a modest pamphlet providing one thousand classes. Attached to it was a relative index to the tables by which all the aspects of any subject in the schedules could be quickly located. This index which, rather than the classification, Dewey considered his important contribution, undoubtedly did much to popularize the scheme, for the classification spread

658.16

AUTHOR Kimball, Dexter S.

TITLE The Organization of Modern Industry

REFERENCE MANAGEMENT and ADMINISTRATION, July, 1923, p.17.

CARD 1. AN ENTRY IN THE NUMERICAL INDEX

rapidly and new editions and new divisions of the tables were demanded frequently. It became the most used system in America, soon spread to England, and attracted attention in Continental Europe. Upon the organization of the Institut International de Bibliographie, about 25 years ago, an exhaustive study of classification was conducted, which resulted in the adoption of the Dewey system.

The French edition of this classification, prepared and issued by the Institut, is a "monument of minute research and special knowledge." While the work already done was not changed, the classes were greatly expanded and certain "form" divisions added which made it possible to classify accurately small and specific literature dealing with more minute topics than books. With the modifications and addenda supplied by the Institut, it is possible to attain a remarkable degree of precision; in fact, it is frequently difficult to know when to stop, and a classifier with a poor sense of proportion may easily carry classification far beyond all reasonable requirements.

In Europe the system has made rapid progress since the war, as shown from the following statement from a report presented to the International Conference of Bibliography and Documentation:[1]

The large government administrations of Holland have adopted the decimal classification of all their correspondence, not only in their central offices, but also in the local offices of the smallest communes of the kingdom; the results obtained with respect to time saved in seeking and collating documents

658.3

AUTHOR Kimball, Dexter S.

TITLE The Organization of Modern Industry

REFERENCE MANAGEMENT and ADMINISTRATION, July, 1923,p.17.

CARD 2. AN ENTRY IN THE NUMERICAL INDEX

are most satisfactory. It has resulted in a considerable extension of the decimal classification into many Dutch private enterprises; notably the Phipps firm applies it to its documents about incandescent lamps, and, in concurrence with the Dutch Institute, it is studying the extension of the tables of electric lighting; one of the largest oil companies also uses it; patents are also classified decimally, etc.

It is known to have been already in use for some time in the Swiss firm, Brown, Boveri et Cie., of Baden. The Forges et Ateliers de Constructions Electriques of Jeumont (Belgium) has put it in use in its technical offices. In France it is used by the Societies des Transports en Commun in the Paris region, the Central Office d'Etudes de Materiel de Chemins de Fer, the Compagnie Central des Chemins de Fer, the Citroen works, the Renault works, etc.

The adoption of this system by publications is likewise spreading, 17 now reaching the Engineering Societies Library in which the index symbol is used in connection with article titles. These seventeen, all technical in character, are in six languages as follows:

Dutch	1
Italian	1
[2]English	2
German	2
Spanish	2
French	9

The Decimal System in Engineering and Industrial Literature

The Dewey classification divides the field into ten main classes, represented in the notation by the decimal system of Arabic numerals. Human knowledge is divided into nine classes, each being given a decimal number as 1, 2, 3, etc., and the numbers beginning with .0 are reserved for encyclopedias, newspapers, and other material too general in inclusion to be assigned to a specific class. Each main class can therefore be represented by a single numeral. Subdivision is always accomplished by tens, so that all numbers being decimals these subdivisions can be marked by adding an additional numeral to some existing number.

The result in application of such a system is accordingly somewhat as follows:

.6	Applied Science
.62	Engineering
.624	Structural Engineering
.6243	Trusses
.62435	Cantilever Truss

Something more is needed, however, by a user of literature, for frequently he wishes to group material from a certain point of view. One, for example, may wish to arrange the subject historically, another geographically. Again one may wish to group commercial statistics by countries, another by industries or products. To meet these various needs is the object of the "form" divisions invented by the Institut International de Bibliographie. These consist of a few arbitrary

658.3

AUTHOR Kimball, Dexter S.

TITLE The Organization of Modern Industry

REFERENCE MANAGEMENT and ADMINISTRATION, July,1923,p.17.

CLIPPING FILED UNDER 658.16

CARD 3. A CROSS-REFERENCE CARD FOR THE CLIPPING FILE

symbols, that are filed in a fixed arbitrary sequence. It would be wearisome to explain these signs here, but the following examples of their use may be of interest as showing their possibilities.

.62113	Locomotives
.62113 (02)	Treatises on the locomotive
.62113 (44)	Locomotives in France
.62113 "19"	Twentieth century locomotives
.62113 : 622	Locomotives in mining
.62113B	Baldwin locomotives
.62113 0014	Locomotive tests
.62113 04	Locomotive boilers
.62113 42	Locomotive valve gears

It might be well in passing, however, to call particular attention to the relation sign, the colon (:), which is perhaps the most important of the symbols adopted. When used in the classification to join two numbers it indicates that the subjects represented by them are considered in relation to each other. It enables us to extend the classification to great lengths in order to express relations without having to provide the ap-

[1] Revue Generale de l'Électricité, v. 12, 1922, p. 417-418.

[2] The two publications in English are both American, being MANAGEMENT ENGINEERING *and The American Management Review.*

paratus in advance. Taking for example, the number for the woodworking industries, 674, and the number for management engineering, 658, we can form the combination 674.658, representing the management of woodworking industries.

The system makes it equally easy to arrange material by the point of view, so that theory, tests, costs, and similar topics will be grouped together. In fact, if thoroughly mastered, it enables the user to attain any grouping that his needs demand. In practice it is usual to omit the decimal point when writing the numbers. It is also customary to divide long numbers into groups by inserting periods, which have no significance except to make it easier to read the numbers. In filing, every number is considered a single decimal.

Adoption by Engineering Societies Library

This, in brief outline, is the system. It is impossible, however, to give any idea of its remarkable possibilities without going into considerably more detail than the average reader will care to have. The important question is how it can be made of value to him.

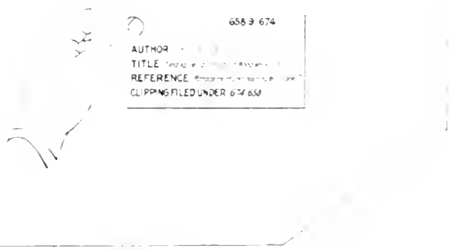


FIG. 1. A CROSS REFERENCE CARD IN THE CLIPPING FILE

Some three years ago a careful study was made of the needs of the United Engineering Societies Library, and the scheme that seemed best adapted to meet those needs was the Dewey classification as extended and modified by the Institut, usually known as the "Brussels" classification. This system was at length adopted, and since then the work of classifying and re-indexing the matter in the United Engineering Societies Library has been steadily going forward. When this work is completed the Library will contain the most extensive grouping of classified engineering literature in the United States.

It has been mentioned that the classification number for management and business methods is 658. For more than a year a joint committee of six societies[3] has been developing the expansion of this number. It is expected that within [illegible] agreement will be reached, and this expansion be adopted into the general Dewey classification. It has already been approved by the co-operating societies. This effort to set up a universally accepted expansion of 658 is a direct outgrowth of the work started by MANAGEMENT ENGINEERING in 1921 in having its articles indexed and printing the symbols as a part of the titles as a guide and convenience to readers.

The general divisions of 658 in the expansion are:

658.1	General. Promotion. Financing. Organization
.2	Plant
.3	Industrial Economics
.4	Plant Personnel
.5	Shop Management. Production
.6	Buying. Receiving. Storing. Shipping
.7	. . . . . .
.8	Selling
.9	Specific Industries

In addition there are other subjects auxiliary to management and administration in industry and business which have been added to 658 under their own class numbers to complete the classification of business methods.

016	Bibliography
026	Business libraries
150	Psychology
170	Ethics

FIG. 2. AN ARRANGED FILE [illegible]

174	Business ethics
325	Immigration
330	Economics
	Transferred to 658.3 for special application in management.
332	Private finance
333	Land ownership, rights and rent
336	Public finance
337	Protection and free trade
339	Conservation natural resources
340	Law
347.4	Contracts
347.7	Commercial law

[3] Management Division of the A. S. M. E. Society of Industrial Engineers, Taylor Society, American Management Association, National Association of Cost Accountants, American Institute of Accountants.

368 Insurance
.1 Fire
.3 Life
.4 Accident Liability
380 Commerce Communication
381 Domestic trade
382 Foreign trade
389 Weights and measures. Metrology
607 Technical education
608 Patents. Inventions. Trade marks
613.6 Hygiene of employment
614.8 Protection of human life from accidents
614.33 Explosions
614.84 Fire prevention
614.88 Aid to injured
620 Engineering
621 Mechanical engineering
.3 Electrical engineering
.7 Factories. Mills. Engineering works
.8 Power transmission
.86 Hoisting and conveying machinery
.87 Cranes and elevators
621.9 Machine tools
628.5 Industrial sanitation
650 Communication. Commerce
651 Office equipment
652 Writing: typewriters
653 Abbreviations. Shorthand
654 Telegraph Signals
654.6 Telephone
.7 Alarms. Bells
.8 Speaking tubes
.9 Signals
655 Printing
656 Transportation: railroading
657 Bookkeeping. Accounting
659.1 Advertising
660 Chemical technology
662.6 Fuel

Classification Plan of Management and Administration Literature

As classification is a specialty in itself and an intricate one, it is desirable to centralize the work, have it done by experts, and then distribute their decisions to the individual user. If, for example, a classification symbol is printed with each article that appears in a periodical it will not be difficult for anyone to build up a consistent file of reference or clippings. All the user need do is to file the article by number and prepare an index to these numbers, or to prepare his index and bind the issues of the magazine in book form. For either method of preservation the index will be the only key to the classification that he will need.

It is for this general reason that MANAGEMENT AND ADMINISTRATION has adopted in this first number the plan of making the index symbol a part of each article. The purpose is most praiseworthy and with the background of experience already acquired cannot fail to yield as a result a usable file of readily accessible data, formed and maintained with a minimum of trouble. From the outset this material will file at once with that previously printed in MANAGEMENT ENGINEERING and with that being presented currently in *The American Management Review*. Clippings from other sources can be added by merely supplying the proper index numbers.

In addition to presenting the broad features of this system of indexing it will be helpful to describe briefly how the system can be advantageously maintained and used in the hands of the industrial executive.

How the Index Is Used

The cataloging of an article or book requires that it be (1) classified, (2) indexed, and (3) that a reference card or cards be made and filed. The first two operations are the work of an expert, and the responsibility for their performance is taken by the magazine, inasmuch as it prints the index symbols as a part of the article. There then remains for the reader and user to build up an accumulative card index. A way in which this may be done is best explained by referring to a specific case.

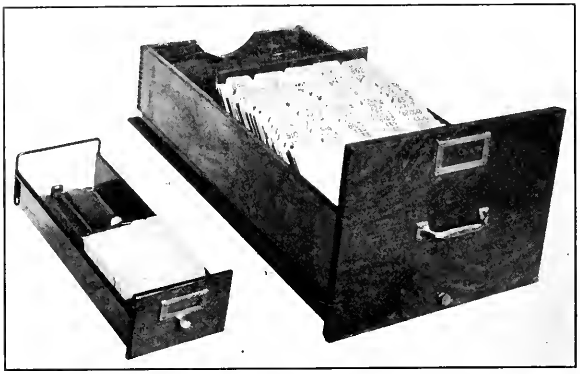


FIG. 3. CLIPPING FILE (RIGHT) AND RELATIVE INDEX (LEFT)

The first major article in this issue of MANAGEMENT AND ADMINISTRATION is "The Organization of Modern Industry," by Dexter S. Kimball. Turning to the first page of this article we find inset in the upper right-hand corner of the second column of the text matter two index symbols or class numbers:

658.16 Organization in industry
658.3 Economics of industry

The class number consists of two parts, at the left the symbol proper, and at the right the corresponding explanatory index entry. Most major articles can be properly indexed in more than one class depending upon the particular interest or point of view of the user. Thus in the case which we are considering this article on "The Organization of Modern Industry" can be classified from the point of view of organization, or from that of industrial economics. The numbers, or symbols proper are the important part, for they stand for the subject which the phrase expresses.

If, therefore, cards are made out containing the indexing symbol, the name of the author, the title of the article and the volume and page for each article in MANAGEMENT AND ADMINISTRATION where there is more than one indexing symbol separate cards must, of course, be made out for each and are filed numerically, an index will be started, so arranged and classified that all of the articles of any one subject will be brought together and found together under one number.

Building an Accumulative Card Index

To locate an article an alphabetical index must also be made, which is done by making out cards carrying both the key words and index symbols given in connection with each article.

The alphabetical index will show whether articles have been published on any given subject, and the class number under which they are filed. Reference must then be made to the numerical index where all the articles that have appeared on a given subject will be found together.

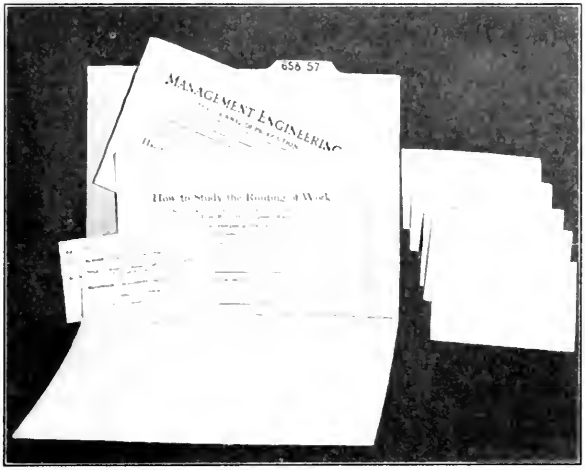


FIG. 4. A JACKET FROM THE CLIPPING FILE SHOWN IN FIG. 3

Directions for Making an Index

This scheme of indexing is so simple in its application that the accumulative card index of MANAGEMENT AND ADMINISTRATION can easily be started and maintained with but a small amount of work if the directions here given are followed:

1. Copy on card for each article in the issue (a printed form such as shown by card 1 may be used) the name of the author, the title of the article, and the volume and page number. Add in the upper right-hand corner the number given at the head of the article.
2. If there is more than one number at the head of an article, make additional cards exactly like the first, only place in the upper right-hand corner the alternative number printed at the head of the article. (See card 2.)
3. File all such cards numerically.
4. Next turn to the relative index and copy each new subject entry on a card followed by its number.
5. File all these cards alphabetically.

Indexing the Clipping File

Turning now to the second way in which the index system may be used, i.e., its application to the clipping file, the result is that such a file may be indexed according to the plan outlined, for the clipping itself is used in the place of one card, and the other cards carry an additional line giving a cross-reference.

Thus in the case used for illustration, the clipping takes the place of card 1, and card 2 is modified in the form shown by card 3, by the addition of a line reading, "Clipping Filed Under 658.16." An alphabetical index is necessary as before.

A convenient way to key both clipping and cross-reference cards is shown by Figs. 1 and 2.

As a practical application to show what such an index and clipping file amounts to, all of the articles published in MANAGEMENT ENGINEERING for one year (July 1921 through June 1922) were clipped and filed in jackets in a file cabinet drawer, as shown in Fig. 3. In all there are 68 jackets, separated into four classes. The first contains economic subjects and comprises all the index numbers used through to 62. The second group comprises technical engineering subjects and includes the numbers from 62 through to 658. The third, naturally the largest group, comprises 658 and its extensions. The fourth section, the smallest of all, includes a few numbers on related subjects. To show the relative size of these four classes the first has 13 jackets, the second 16, the third 29, and the fourth 10, making a total of 68.

In Fig. 4 is shown the open jacket for 658.57 Routing Systems. It contains two articles and three cross-reference cards of articles filed elsewhere. At the right of this open jacket are three cards from the accumulative relative index, which give references to the subject Routing Systems 658.57.

Thus this system which becomes with the first number one of the special features of MANAGEMENT AND ADMINISTRATION, has the background of practical application which seems to substantiate many of the advantages which are claimed for it. The writer is one who has had the question of classification in his concern for many years, and is deeply interested and gratified by this forward step. He hopes to see this system generally adopted by industrial and engineering magazines, believing that it offers a practical way to overcome the difficulty of finding filed material.

To the large plant this method of indexing and filing should prove a positive time and cost saver. Most industrial concerns of major size have plant libraries and technical files which executives and employees consult constantly to improve management and operating methods. Small plants have in the classification scheme here presented a ready means to profit by similar procedure.

THE EDITORS' PAGE

To Our Readers

IT gives the editors of MANAGEMENT AND ADMINISTRATION much pleasure to present to their readers this larger and stronger magazine devoted entirely to the interests of effective executive control. In it the readers of *Administration*, "the journal of business analysis and control," will find the subject matter which has heretofore appeared in that magazine. In it they will also find the contents of *Management Engineering*, "the journal of production control," for these two publications—both pioneers and leaders in the field of control—have been consolidated in the present magazine.

MANAGEMENT AND ADMINISTRATION, the magazine resulting from this combination, is the largest and strongest publication in its field. Its editorial staff includes the editors of both *Administration* and *Management Engineering*. The articles appearing in the body of the magazine have been increased in number. Every special feature of both the consolidated magazines has been retained. "The Editors' Page," "The Readers' Page," "Conditions and Prospects in Business and Industry," "Current Book Reviews," and "Management Data," covering in stronger form the corresponding departments of both magazines.

To sum the matter up, our subscribers now have a larger, a stronger, and, we believe, a better magazine, and at no greater cost to themselves. Its editors can only hope that the friendly appreciation and support so freely given to *Administration* and *Management Engineering* will be continued in the same generous measure to MANAGEMENT AND ADMINISTRATION.

Untapped Industrial Capital

THE wage-earners of the United States receive annually some $30,000,000,000 in earnings. It is estimated that at least $500,000,000 of this amount is invested each year and lost. That is, labor buys worthless securities and is stung.

One reason for this condition is the cost of merchandising securities to persons who have only a small amount of money to invest. The highest grade investments are sold on a narrow margin of profit, and so can be marketed only by direct selling in large blocks. Investors who can buy largely do not buy low-grade or questionable securities, and these are offered to persons of small means by a horde of salesmen. Their nature admits of a wide enough marketing profit to carry the cost of sending salesmen to a large number of people.

It is not at all unusual in instances of this kind for the stock-selling house to receive a commission for the sale of securities as high as 40 per cent. This means that the opportunity for probable success of the venture is reduced, as only 60 cents of every investor's dollar is put into productive activity.

As a result, the wage-earning investor buys questionable securities marketed on such a basis that the earning power of every dollar invested must be exceptionally great in order to return a dividend and build up sound conditions, if the enterprise has a business chance. But many of them are incompetently managed, and others of a wildcat nature. Take it all in all the one who buys such securities is pretty apt to suffer.

During the past half decade labor has been given a voice in its own management. Witness the establishment of works councils. Here and there through stock purchase plans labor has found an investment for its savings in the industries where it is employed. Thus two paths are already blazed for labor, the one toward an understanding of management responsibilities, the other toward direct financial participation in the enterprises.

However, the progress along the second way is less far advanced than along the first. What is needed is some means or plan whereby the wage-earners' savings which come from productive industry may be turned back into worthy enterprises to the strengthening of our industrial and business fabric and to the creation of good-will and understanding. Once this plan is found millions of dollars now untapped will be available for the upbuilding of industry and the nation.

The Demand Prospect

EFFORTS to forecast future business or industrial conditions are largely attempts to foretell demand or evaluate the demand outlook. What every executive would like to know is how much product he will be able to sell, or be called upon to produce or to finance, and what materials and supplies must he secure from other manufacturers during the next few months—that is; What will be the future demand?

To assist in answering this universal and pressing question MANAGEMENT AND ADMINISTRATION presents in this first issue a department of economic and industrial facts under the heading "Conditions and Prospects in Business and Industry." Its first sections particularly deserve explanation and emphasis.

The leading illustration dealing with general conditions indicates that future demand as a major forecast is a factor of the business trend. Its principal line expresses an index-number ratio between current prices of goods and volume of goods. That is, the points plotted month by month are from the fraction $\frac{P}{V}$; in which P equals the index number of price level (Bradstreet's index number of wholesale prices), and V equals the index number of physical volume of trade (car loadings times tons per car).

Now both price and volume (supply) have an influence on the demands for goods. If *present price* is comparatively high and *present volume* comparatively low, then the *present demand* will be strong and this tendency is likely to persist over the period of the immediate future. That is, a future strong demand is indicated by present high demand and low supply. Conversely, a future weak demand is indicated by present low price and ample supply.

Expressed in symbols this relationship is

$$D = \text{Demand intensity} = \frac{P}{V} \text{ [illegible] as } \frac{P = \text{Price}}{S = \text{Supply}} \text{ [illegible] as}$$

P = Price

V = Volume

Therefore the $\frac{P}{V}$ line which will be presented monthly is believed to indicate the probable trend of future demand. It will provide industrial executives with information to assist in making major operating plans and in determining general policies.

Dr. Lewis H. Haney who has developed this formula and curve has broken with much of the past economic thinking concerning the business cycle which sought to establish mathematical equality between certain economic factors. Realizing that the rigidity of natural law does not hold for relationships which are influenced by human desires and the human will, he sought to express the *basis of variation* of those factors which affect the ebb and flow of industrial and business activity, rather than to equate the factors themselves.

A few minutes may be required of the reader to appreciate the significance of all the lines on the chart. But the time spent will be well repaid, for in a small space, which can be seen almost at a glance, are put in graphic comparison statistics which could only be interpreted by hours of study of figures and tables. The chart form is used because it is useful, a real help to the busy executive.

MANAGEMENT AND ADMINISTRATION believes in the soundness of Dr. Haney's theory and the practicability of his method of attack on the problem of the business trend. Therefore, the line expressing the variation in demand intensity will be a regular feature of the department presenting industry and business trends.

The Industrial Outlook

THE attitude of the present-day manufacturer is, of necessity, one of watchful activity. The records of the past must be scrutinized with constant care for these give him the foundation upon which to build his future. He must keep a keen watch on the present, for here his industrial history is in the making. He must look ahead far and intelligently in order that well laid plans may guide his present progress.

In another column a helpful article by W. Randolph Burgess of the Federal Reserve Bank of New York, "Labor Shortage and Industrial Profits," gives a bird's-eye view of the present industrial situation together with suggestions of what is to come. As Mr. Burgess states them, the conditions are unusual. The number of factory employees has decreased, but in spite of this there is an acute shortage of industrial workers. And yet, in the face of this shortage of industrial workers, factory output has increased.

The reasons for these paradoxical conditions are explained with much clearness by Mr. Burgess. Production has increased, even though the number of workers has diminished, through the more extended employment of [illegible] of better methods [illegible] among [illegible] are [illegible] of supply [illegible] have been drawn [illegible]

So far, so good. [illegible] exist and to ma[illegible] unduly the price of his goods [illegible] because he has increased his output without increasing the number of his workers. But what of the future? Can this satisfactory margin between cost of production and selling price be kept up? There is the organized pressure on the part of labor for higher wages, wages that will enable the working man to maintain or even raise his present standard of living. Other costs also tend to increase. On the other hand, prices of output cannot be materially raised without danger of killing demand or bringing on a buyers' strike which might upset all industry. The only solution of the problem seems to be to increase further the per capita output. Can it be done?

As to this Mr. Burgess says:

> It may seem difficult to conceive of an increase in efficiency as great as occurred after the Civil War with the introduction of large scale output. Yet in the industrial experience of the past few years there is found reason to believe that a corresponding increase in efficiency is not at all impossible. The principles of quantity production are now being applied on a scale not before dreamed of. In the invention of labor-saving devices the present era is as fruitful as any of the past. Most of all, under the pressure of labor scarcity and high wages we are learning to arrange working conditions so that each workman may be able to do his best work. . . .

As increased efficiency is a matter of slow development Mr. Burgess thinks the material increase anticipated may take some time to achieve. It is, though, from his viewpoint the one thing that can save the present situation. Meanwhile there are difficult times ahead for the manufacturer. These may be shortened or largely avoided by a clear realization of the conditions, and a direct and persistent effort to increase output without proportionately increasing costs.

Collective Bargaining and the Closed Shop

THAT approximately 17,500,000 employed men and women in Germany are now working under contracts arrived at through collective agreements is one of a number of significant facts revealed by Emil Frankel in his article in this issue of MANAGEMENT AND ADMINISTRATION.

The principle of collective bargaining appears to have made distinct gains in recent years in America as well as in European countries. It has been recognized by manufacturers and utility executives employing thousands of operatives; approved in principle by many civic and ecclesiastical bodies, by the government, particularly during the war, and in a most spectacular manner endorsed by the Second National Industrial Conference held during the Wilson administration.

And yet it must be said that American industry as a whole still lacks satisfactory machinery for negotiation between management and workers. "Collective bargaining" continues to have a strange sound to many ears that have long been accustomed to such militant words and phrases as "strike," "lock-out," and "the closed shop." In fact, the first reaction of many executives to Mr. Frankel's article will doubtless be: "Just how is all this German experience related to my labor problem?" In the minds of some, collective bargaining is commonly identified with labor union activities or the strike itself. But there are many observers who view collective agreements as something entirely different—labor's substitute, perhaps, for the strike. An American investigator well known as a friend of labor, has recently gone on record to the effect that although industries, in which collective bargaining is well established, occasionally do have strike trouble, the fact remains that the substitution of conference and agreement for strife and recurrent interruptions of work, a change effected largely by means of the collective agreements, is most significant.

Collective bargaining, of course, may and does exist in many plants where there are no labor unions. Wherever a selected spokesman or a committee meets an employer or a group of employers to negotiate a working contract, there is collective bargaining in operation. The absence of a labor union may actually help the progress of collective bargaining, for naturally many employers who admit, in principle, the justice of some method of conference and agreement, object to the procedure when it comes to them bearing the union label. They rebel at dealing with a "walking delegate," and insist on negotiating with their own employees, independent of any organization of "outsiders." Witness the development of works councils during the last five years.

While not directly in point, one interesting phase of the long-waged fight between the ideas of the open and the closed shop may be mentioned here—the steady growth in size and power of a contingent occupying "middle ground." This compromise position has received the name "preferential shop," a notable example of which is the extensive garment manufacturing enterprise of Hart, Schaffner and Marx. Under the "preferential shop" plan, the employer agrees to employ none but union members so long as the union can furnish an adequate supply of them. Beyond that point he is not bound.

But collective bargaining may function in all three—the closed, the open, and the preferential shop. And that there are many employers as well as employees who hope to see it function with increasing power is evident to any careful observer of current industrial development.

The Standardization Opportunity

MANAGEMENT AND ADMINISTRATION has made a rough classification of American standards into two main groups, dimensional and industrial. A large number of dimensional standards exist and they are well known, to a great extent, through commercial use. Industrial standards, however, are not familiar to manufacturers. The Management Data Sheet in this issue contains a compilation made of the latter group, which includes classifications, grading of materials, storage and loading, installation codes, operating and testing codes, safety, sanitary and fire protection standards, and standards concerned with methods in the manufacturing field.

The knowledge and use of these standards and their further development to a high state of perfection offers one of the most direct, practical and profitable means of lowering industrial costs by eliminating a large source of present wastes. Moreover, such means provide probably the most potent factor in ending the age-old and absolutely needless shifting of industry with the uncontrolled tides of business fluctuations. No more direct and certain road exists toward the much-desired goal of stabilization.

Realizing this, the American Engineering Standards Committee is energetically lining up American industry in a sound campaign of industrial and dimensional standardization. Many of the national trade associations are also thoroughly convinced of the imperative need of such standardization to preserve the health of American business and to keep American goods on the foreign market. The great need at present is a comprehensive study of all American standards affecting the purchase of material and manufactured articles of every sort. Such work should not be of a limited nature but should appeal to every individual American industry, lining them all up behind standards mutually acceptable to maker and buyer for every article of domestic and foreign commerce.

Probably two types of standards can be agreed upon for each case—one the rough and ready inspection which, if an article is acceptable—to both manufacturer and purchaser, will complete the purchase; and the other an umpire test to be applied when either side rejects the results of the inspection test. The latter will constitute a thorough laboratory investigation.

Many manufacturers buy material now under specifications which they do not apply as a check when goods are received, the expense being too great or facilities lacking. Moreover, a large percentage of the articles of commerce are purchased under specifications which are far above the needs of the case and for which much cheaper material could probably be substituted with, in many cases, even better results than the specified material would give. In addition, these materials may be really special products and therefore a source of waste through larger manufacturing costs.

Aside from the facility with which purchasing will be possible and satisfaction obtained under the standards to be thus compiled from those at present most agreeable to all parties concerned, which can be published for voluntary but, it is to be hoped, universal use, the stabilization factor enters in as a tremendous possibility. Manufacturers will be able to make standard materials and articles at low cost in so-called dull times in commercial affairs, knowing that when demand again livens up, the goods so produced will be just as marketable from the dimensional and test standpoint as if produced immediately prior to sale.

THE READERS' PAGE

Commodity Price Cycle Charted

A NEW YORK banker recently remarked "Business men today talk very little, except in cycles." Whether or not this is strictly true, the following letter and the accompanying chart, contributed by a well-known accountant and appraisal engineer of Toledo, Ohio, should prove of interest to our readers:

Editors of MANAGEMENT AND ADMINISTRATION:

The enclosed chart may be of interest to you in connection with the subject of valuations. It is a chart of Commodity Price Cycles which was used to good advantage in a hearing before the Public Utilities Commission of Ohio. Similar charts have been put out by Babson's Statistical Organization and others, but nowhere have I seen an analysis of similarities between cycles such as we have made. On my chart I show two complete cycles and part of the present cycle. I found that the duration of falling prices is twice the duration of rising prices. If Babson's theory of equal action and reaction holds true, then we should expect the low point for the present declining prices to be lower than former low points. However, for the sake of conservatism I assumed that the present fall would go no farther than the last two low points.

In attempting to determine whether or not prices decline according to mathematical law, I fitted various curves to the preceding cycles. The parabolic curve seems to satisfy better than any other. This seems reasonable in that all bodies projected horizontally would fall along a parabolic path. The variables in the formula $Y^2 = cX$, would have to be reversed from those in the formula for falling bodies. On the enclosed chart I have shown three parabolic curves to represent the normal paths of decline. You will appreciate, however, that it is improbable that the peak of a cycle and the low point of a cycle would lie on the normal path. If this chart will be of any use to you, you may use it in any manner that you desire.

CARL H. SCHUTTLER.

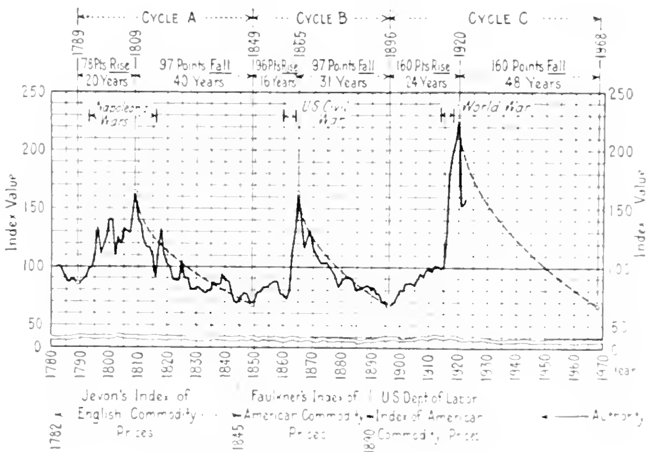


FIG. 1. COMMODITY PRICE CYCLES

Similarities in the first two cycles, A and B, may be repeated in the present cycle, C. The low point of the fall may be the same, or lower. The duration of the fall may be double the duration of the rise. The normal path of the fall may be a parabolic curve.

Attracting Workers to the Woods

THIS letter, from the manager of the employment department of the Pacific Lumber Company of Scotia, California, should have no little suggestive value for executives who face the difficult task of drawing workers from the centers of population to spots considered by the average operative to be "very far from Broadway."

Editors of MANAGEMENT AND ADMINISTRATION:

Our industrial engineer, Mr. C. A. Ma[illegible], suggests that your readers might be interested in a piece of employment work we are doing out here that seems to us to have features somewhat out of the ordinary.

As we employ nearly 2000 people, in a settlement 260 miles north of San Francisco, it is obviously something of a task to get them to come here and to make them comfortable enough to want to stay with us. What I want particularly to describe in this letter is our method of attracting the workers, and getting them to leave the "bright lights" to take up their lot with our enterprise.

First of all, a word about our town and our company. Scotia is in Humboldt County, California, the "Home of the Redwoods," and is about 29 miles south of Eureka on the Northwestern Pacific Railroad and the California State Coast Highway. The climate is temperate; neither very hot in summer nor cold in winter. Snow is practically unknown and flowers grow the year around. The town site is owned solely by the Pacific Lumber Company, and we put forth every effort to make our employees as comfortable and contented as possible. We provide modern unfurnished houses of various sizes and types, with bathrooms and stationary wash tubs, filtered water and electric lighting, with reasonable rental rates. Single men may obtain accommodations in rooming houses furnished with tub and shower-baths, sanitary lavatories, electric lights, comfortable beds and bedding, and good board at the very reasonable rate of \$1 a day.

As for the work, we operate two saw-mills with a capacity of about 125,000,000 ft. a year, cutting on a 9 hr. day shift.

We have enough Redwood timber to allow cutting for the next 50 years, at the present rate, and re-forestation will extend the 50-year period indefinitely. In our two sawmills we operate seven band saws, one gang saw and one re-saw. We employ responsible white men only, between 20 and 45, and pay them from 40 to 80 cents an hour according to the grade of service rendered.

We get our prospects by newspaper advertising, chiefly in the southern states and in cities and towns where there are considerable numbers of "lumberjacks." It is the follow-up of these prospects that would seem to be of interest to the executives who read your magazine. The chief feature of our system is a combined letter and illustrated circular giving the essential facts concerning our enterprise and its opportunities for workers. It consists of a four-page folder, $8\frac{1}{2} \times 11$ in., on good paper. The inside spread carries 18 small cuts illustrating various parts of our plant and processes, and a panoramic view in colors of the town of Scotia and the wooded hills beyond it. The outside pages carry the letter material, covering wage schedules, hours of employment, housing conditions and general information of value to the prospective employee. We have two forms for this letter, one bearing on the woods operation exclusively and the other covering the entire enterprise.

Last year we furnished transportation to several groups of men from Maine and Minnesota. This spring our advertising in southern papers brought about 500 replies, which we are following up as stated above, with every indication of securing the requisite number of desirable operatives. In the case of mechanics or high-grade men, we send an original typed reply, but use the same folder provided for the general circular letter, with its attractive pictorial spread. The reaction of prospects to this plan, as well as that of several executives who have studied it, has been uniformly favorable.

B. H. MARTIN.

American Trade in England

THE following communication, from the president of The Trane Company, manufacturers of heating systems, will doubtless strike a responsive chord in many Americans who have learned by experience that breaking into business in England involves not only a good product and sales ability but not infrequently a cutaway coat, a pair of striped trousers, and a taste for tea.

Editors of MANAGEMENT AND ADMINISTRATION:

Before going abroad on a recent business mission I knew of many differences between American and English methods, but felt that I should be able to get business in true American fashion. I fully expected to complete my mission in a few days and return to the United States knowing, to say the least, whether or not I had been successful. My object was to establish an outlet for our merchandise; start an organization working, using the same methods, systems, etc., that had proved so successful in the United States. I felt that I had a truly wonderful business proposition to offer; one that would establish a permanent business at a minimum cost of operation, modeled and guided by the American parent company as developments took place. This would automatically avoid expensive mistakes and progress would be smooth and certain.

With this idea firmly in mind, a solid week of time provided to accomplish my purpose, and my English friends advised of my coming, I arrived in London. Here my trouble began. I outlined our whole American scheme—advertising, literature, education of salesmen, and inner office systems—and tried to convince them of the extreme simplicity and successful certainty of the plan. They were interested, of course, but that was all. Nearly a week passed before I began to realize that my lack of progress was because of my American ways; and that I was getting exactly nowhere.

I concluded that I was trying to rush through a business arrangement that needed more time and study than I was giving it (from the English point of view) and that I was likely to be unsuccessful unless I changed my method of attack.

I then called upon the members of some American firms which were successful in England. They verified my conclusions. These firms are managed by Englishmen, and do business in an entirely different way than their parent company in America. Practically nothing is handled in the same way as in America. Hundreds of firms that have tried to do business in our way have failed. There are practically no cases of high-grade American salesmen who have proved anything but failures in England. The English salesman knows his people. Their habits and his are alike. He gets business through the merit of his goods, his personality, and services just as we do, but English goods, personality, and service are different from the American.

A study of English catalogues (note spelling), newspaper advertising, and letters brings you to the same conclusion—most of the American literature (fancy calling advertising matter *literature!*), bulletins, mailing pieces, etc., are all wrong for real results in England. If you want business in England and need to advertise, either have it done by Englishmen or have the copy edited by them before printing. Englishmen are perfectly willing to buy American goods but there is no use flaunting a flag to remind them in every line that they are American made. They probably prefer our merchandise but will not be encouraged to buy by the words and phrases we are accustomed to use. I believe we have progressed in the art of printing and go into more detail in our advertising literature, and that we can keep this advantage by having our literature at least edited by the Englishman.

Our form letters are just as different as the other things. It would be folly to send letters written by Americans to the English trade. Our letters must be carefully edited, and we must not count on them even then to produce the same results they do in this country.

All of which is the result of many conversations I have had, many inspections of literature, letters, advertising, etc., and it was with this new angle that I tackled my little problem of finishing my job before returning home. I had to back up and use a new angle. I had to acknowledge that I undoubtedly would not be a success as a salesman in England; that I could not exhibit methods and schemes for selling which were sure to be a success; and that I could best accomplish my purpose by starting a selling organization that would be handled by Englishmen in the English way. I had learned to like the English business man, to believe in him, and to see that even though he did not get to work before 9 or 10 o'clock in the morning, took coffee before noon lunch and tea at four in the afternoon, he was a hard worker who got real results and knew thoroughly how to do business. I had learned, further, that I could, above all things, trust him to do exactly what he said he would do and to know that when he encouraged me there was reason to be encouraged.

With this new view of the matter, even though the conclusion took two weeks longer than I expected, matters were easily arranged. We will give them all our American schemes for revision to [illegible] method of doing business. We will arrange for the carrying of stocks by giving extended terms for payment. There will be English salesmen. We will let it be known that the goods are American made but we will not "holler" about it. They do not believe that "American made" is necessarily a guarantee of quality. In fact, in such a great manufacturing country as England, with fifty millions of people, lucky is the American manufacturer who can make anything that can have the advantage of either quality or price.

American made goods are rarely sold in England without some special adaption to that country's requirements. Sun Maid Raisins are put up in "two and a half pence boxes." Gum is called "chewing sweets" and cannot be sold in slot machines because of the climate. Parts of Gillette razors are made in England. A Ford is a right hand drive machine. Few of the American cars can be sold unless they have English coach work. A Dodge is bigger than nine tenths of the cars in England. Hardware stores and jobbers, in our sense of the word, are not the same. The relationships between architect, general contractor, engineer, mechanic, and owner are not just what they are here, and in many cases we would like the English arrangement better.

Because of these many differences, the successful American manufacturer must adjust his product, practices, and methods to make buying easy and ordinary. Glaring differences in appearance and methods of selling must be avoided. A manufacturer may do business without these adjustments through a few connections secured by good fortune or chance, but unless he sees England, studies English methods and markets, and does adjust matters to suit their needs, he cannot reasonably expect a large business.

REUBEN N. TRANE

The Use of Dictating Machines

THE letter which follows embodies a number of timely suggestions concerning "substitutes for stenographers." The writer is an accountant, on the staff of Messrs. Lybrand, Ross Brothers and Montgomery, New York City.

Editors of MANAGEMENT AND ADMINISTRATION:

A large part of the service which a lawyer, an accountant, or an engineer renders to his clients consists in the successful "selling" of ideas. The lawyer convinces the judge (or the person whom his client wishes to convince) with his brief or with his legal opinion. The accountant convinces his client as to the accuracy or inaccuracy of his books of account with his reports, and after having convinced the client, convinces those with whom the client has business dealings—including the revenue agent. The engineer "sells" his ideas with his written opinion upon conditions as he finds them, and upon the changes which he recommends.

The opportunity of the accountant who cannot write a convincing report is limited to a large extent to the compilation of figures. He must delegate to another the important work of "selling" the ideas which his figures call into being. This statement is especially true today, when the accountant is expected to represent his client in tax disputes. Similarly the engineer who combines scientific knowledge with a forceful grasp of language is much more sure of success than his more brilliant co-worker who cannot or will not express himself.

If, then, words are so important, professional men owe it to themselves and [illegible] an instrument [illegible] peal [illegible] a semblance [illegible] instrument [illegible]

The use of the [illegible] ordinary correspondence [illegible] limitations, but experience [illegible] have been quicker to see [illegible] have professional men [illegible] of the [illegible] to the "24 hour stenographer" [illegible] appear [illegible] able manner after a few [illegible] truth is that the limitations, [illegible] as they are, [illegible] dictator and not in the machine. Proper management and organization will more than counteract any possible advantages which the stenographer with her notebook [illegible] (or may be thought to have) over the machine.

Little has been said, however, of the use which [illegible] made of machines in the drafting of briefs, reports, and technical opinions. All the advantages of the machine [illegible] may be urged in discussing correspondence apply with equal force in the case of briefs and reports. The saving of time alone makes the use of the machines worth while. A study of the work of the stenographic force of any fairly [illegible] professional office will indicate that routine correspondence is negligible when compared with the amount of time spent in the preparation of briefs and reports.

Ordinarily a brief, report, or opinion is prepared in draft form by a subordinate and then approved or rewritten by a superior. In nine cases out of ten the subordinate laboriously writes out the draft in longhand, which is in itself a waste of time. If he is lacking in proper consideration for his superior's eyes and nerves, he presents to his superior his draft so written. He may have the draft typed from his manuscript before showing it to the executive who is to pass upon it. This entails additional and nerve-racking labor for the typist, since professional men (including accountants) are fast losing, or have lost, any reputation they may have had for good penmanship. In a few cases, the subordinate may dictate his draft to a stenographer. Such a course can never be satisfactory, however, in the case of a long brief, because the shorthand stenographer's physical endurance is limited. If the brief is long enough to necessitate more than two hours' dictation the draft must be dictated either in sections or to more than one stenographer. In any case, if the brief writer in the first instance dictates his argument to a machine, much is saved: his time, the time of a stenographer, and the time of the executive who is to approve the draft.

The objection may be raised that changes cannot be so easily made in the course of preparing a dictated draft as if the draft were written out in longhand. But how many reports leave a professional office in the form in which they are originally prepared? If the report writer, having his material properly prepared, dictates to a machine, and if the machine operator types the draft so dictated in triple space type, all necessary changes can be made much more economically and expeditiously than under the archaic method of writing the whole draft in longhand.

Every professional man knows that the work of his office is not uniform. At certain times and often quite unexpectedly briefs and reports must be prepared on very short notice. This often entails work after office hours and is probably one of the most prolific causes of large labor turnovers in the stenographic department. One of the many advantages of the dictating machine is that it obviates the necessity of holding a stenographer or stenographers after office hours in order to dictate rush reports.

JAMES O. WYNN, JR.

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

PREPARED BY LEWIS H. HANEY[1]

Director, New York University Bureau of Business Research

The Barometer of Industry and Trade

The barometer reading for May and June shows an unfavorable outlook for business. In none of the five factors involved is improvement shown, while the main curve, the $\frac{P}{V}$ line, shows a decided drop. Perhaps some small comfort may be gained in the apparent tendency toward a halt in the decline of prices, of which there has been some sign lately; and it may be argued that the continued upward trend of the interest rate shows no major downward swing in the business cycle as yet. It is not likely, however, that the price curve will turn up in June, and there is some evidence of an easing in money rates. Furthermore, the interest rate is generally slow to show a downward trend when business declines.

[1] Valuable assistance was given in the compilation of data by Karl W. Johnson and Horace J. Barney of the Bureau Staff.

The underlying trouble is the great increase in production, accompanied by a maladjustment in industry which weakens the power of consumers to absorb the rapidly swelling output. There is apparently overproduction in certain industries, and purchasing power is unequally distributed. The situation is illustrated by the weakness in the rubber tire, petroleum, and cotton-seed oil industries. Perhaps the automobile and cotton goods industries are to follow. Demand at the recent high price levels failed to hold up. It has proved weak relatively to supply. Price declines have followed, and it has been necessary to check output in many lines. The following are among the industries which cannot be said to be doing well, as is illustrated by the price of their securities on the stock exchange: shipping, leather, cotton-seed oil, fertilizer, copper, petroleum, and, perhaps, farm machinery and paper.

The trouble has been greatly accentuated by the decline in exports, which has attended the relatively low purchasing power of European countries.

The latest data show that to an increasing extent wages in this country are out of line with prices.

An examination of the details of the barometer leads to the following conclusions:

1. The Six-Commodity Price Index of the New York University Bureau of Business Research shows a decided decline in May. It stood approximately at 186 in April and at approximately 180 in May. Bradstreet's index shows a general decline in wholesale commodity prices. While there has been some evidence of firmer prices lately, the outlook is for further decline in June.
2. The interest rate on commercial paper remained unchanged during May and the early part of June, although the larger volume of paper was moving at

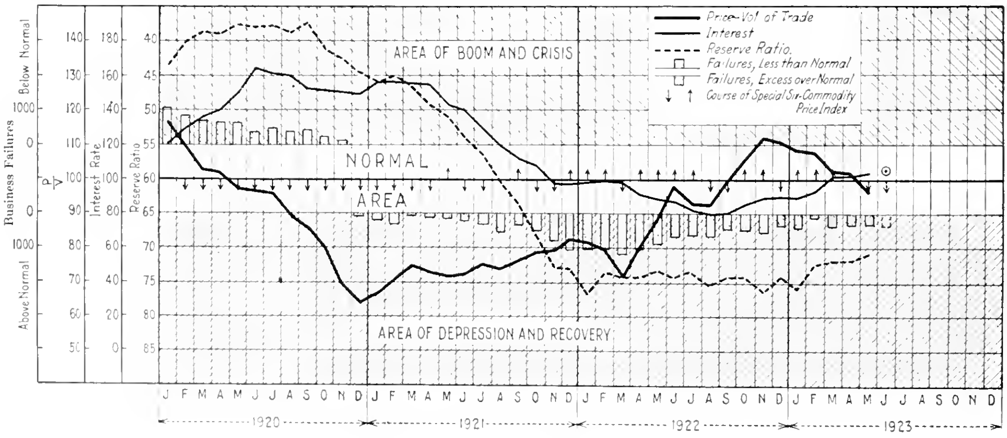


FIG. 1. THE BAROMETER OF INDUSTRY AND TRADE

Areas in which curves lie indicate that business is good, normal, or poor, respectively. Curve P/V shows ratio between Bradstreet's index of wholesale prices and physical volume of trade (carloadings times tons per car) based on 1912 as the normal year. (See editorial, page 84.) Interest rate index number 100 equals 5 per cent. "Normal" for failures equals trend during 40 years. Reserve ratio plotted on inverted scale. Six-Commodity price index based on N. Y. U. Bureau special investigation. June 1923 data shown is probable trend.

the minimum rate. With seasonal variation eliminated, however, the index number showing the trend of interest rates moved upward and is now appreciably above the center of the normal area in the barometer. Money rates are usually a good index of current business conditions, and there is hope that business is not headed for a major depression, as long as the interest rate curve continues upward.

3. The bars in the barometer which indicate the excess of business failures over normal still project into the "area of depression and recovery." The excess of failures was somewhat less in May than in April, but the outlook for June is that there will be another increase. This is a clear indication that business is not normal and that the necessary readjustments in prices, wages, production, and foreign trade have not been completed.

4. The "$\frac{P}{V}$ line," which has now been adjusted for normal growth in physical volume, showed a considerable decline in May, falling from 101.5 in April to 95.3. It is now in the lower half of the normal area and forecasts further decline in the intensity of demand for commodities. This means a continued weakness in markets and probably decreased earnings in many industries. (It is unlikely that the upward trend of the stock market will be resumed until the downward trend of the $\frac{P}{V}$ line is halted.)

5. The federal reserve ratio, as adjusted for seasonal variation declined slightly in May, which causes the inverted curve shown in the barometer to rise. It is impossible yet to forecast the June trend of the reserve ratio, but it seems likely that it will decline slightly. In any case it is clear that the basis for credit in the federal reserve system is ample. The present troubles of business are not due to tightness in the money market, nor to strain on bank credit.

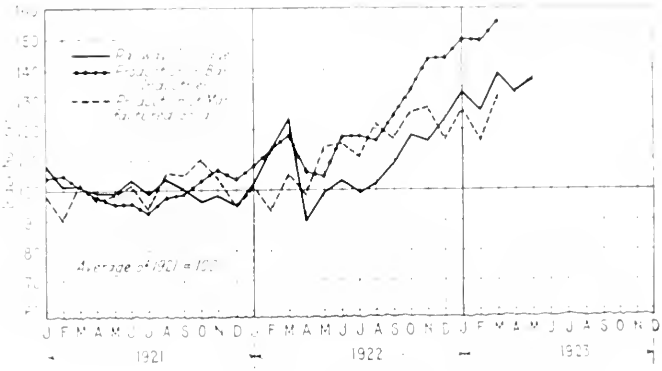


FIG. 2. RAILWAY TONNAGE AND PRODUCTION IN BASIC INDUSTRIES AND MANUFACTURED GOODS

Railway Tonnage, New York University Bureau compilation. Corrected for seasonal variation. Source of production curves, Federal Reserve Board.

Production and Movement of Stocks

Production in Basic Industries Reaches High Point: Index Numbers of Trend of Industrial Output Steadily Upward. See Fig. 2.

The Federal Reserve Board computes monthly an index number based on the physical volume of output for the chief basic industries of the country. This index number is adjusted both for the normal growth of industry and for the seasonal variations which occur in production, and consequently it is calculated to indicate the cyclical trend. This index number of production in basic industries is only available through March. In that month, it stood at the highest point yet reached. In May 1922, the index number was 104.6, while in March 1923, it had reached 156.3, which is an increase of 52 per cent. Judging by the reports of activity in various important industries, the index number should hold up for some months.

The Federal Reserve Board also computes an index number of production in the manufacturing industries. This index number is not adjusted for seasonal variation and consequently shows greater fluctuations than the other. The minimum last year was 93.4, from which point it increased to a maximum in March 1923 of 131.3, an increase of 40 per cent.

The volume of railway tonnage is closely related to the industrial output and shows a close correlation with the output of manufactures, although the coal strike and the strike of railway shopmen affected the tonnage figures last year. The general trend of railway tonnage has been steadily upward, the index number in March (139.2) reach-

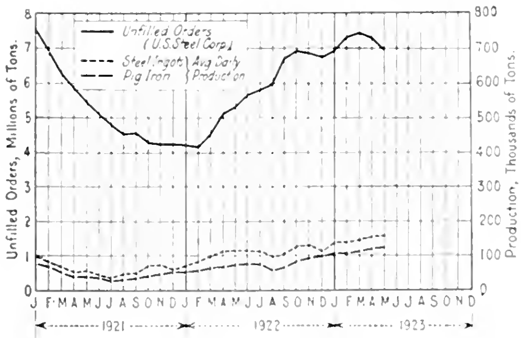


FIG. 3. IRON AND STEEL PRODUCTION AND UNFILLED ORDERS

Sources, *Iron Age,* American Iron and Steel Institute.

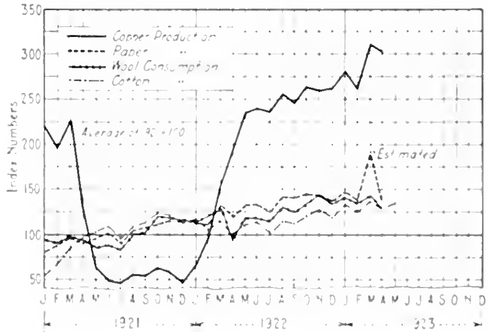


FIG. 4. PRODUCTION IN FOUR IMPORTANT INDUSTRIES

Sources, American Bureau of Metal Statistics; Federal Trade Commission; Bureau of Census; Department of Commerce.

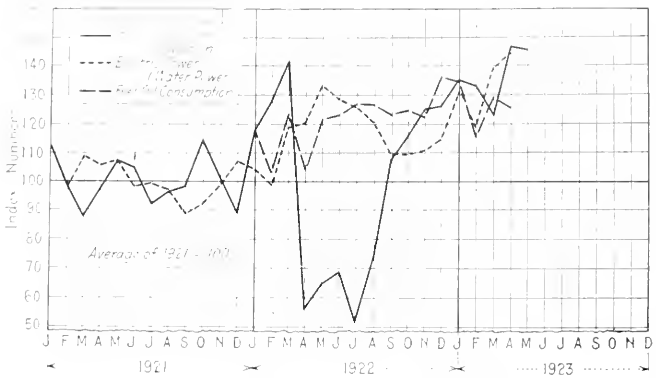


FIG. 5. FUEL AND POWER PRODUCTION

Sources, Department of Interior; Bureau of Mines; United States Geological Survey.

ing the highest point ever attained, and standing at 137.4 in May. (The figures are adjusted for seasonal variation.)

The questions which confront industry at the present time are: (1) Are markets such that the present high volume of physical production—a volume which is roughly 50 per cent greater than in 1921—can be maintained; and (2) Will the high volume not result in still lower prices? As the unsatisfied demands left over from war times are filled, it seems likely that a less intense demand and a lower price level will be experienced. Already wholesale prices have declined considerably and the weakness of export markets constitutes a problem.

Pause in the Iron and Steel Industry: Pig Iron Production Breaks All Records in May, but Daily Steel Output and Unfilled Orders Decrease. See Fig. 3.

The average daily production of pig iron in May showed a great increase over April and the total production for the month was 3,868,000 tons. The total for the month was the largest on record. The average daily output has increased steadily since August 1922.

While the total production of steel ingots in May, which is estimated to aggregate 3,538,000 tons, is the highest monthly total on record, the average daily production decreased from April. This is the first decrease of the year.

The unfilled orders of the United States Steel Corporation at the end of May amounted to 6,981,000 tons. This is a decrease of 307,000 tons from April which is a considerably larger decrease than had been anticipated. Moreover, it is the second successive monthly decrease. The high record for unfilled steel orders was made in April 1917, when the figure was over 12,000,000 tons.

These facts seem to lend some support to the conclusion that new business is slackening. While production in basic industries holds up at near peak levels, the intensity of demand is not sufficient to maintain prices. Pig iron prices have shown a declining trend for several weeks and the semifinished steel market is easier. There has recently been a fair demand for fabricated structural steel, but a decline in the concrete bar awards. On the whole, steel prices are fairly stable. Premiums for prompt deliveries have disappeared.

The unfilled orders of the Steel Corporation have long been recognized as a fairly good barometer of the industrial trend. At present there is a slackening in demand as related to supply which does not, however, necessarily indicate the beginning of any real depression in the steel business. It is a fact that new business booked during May is estimated to be at the rate of only 75 per cent capacity, but the steel corporation has enough orders on its books to keep it busy for the rest of the year. Furthermore, several large orders for rails will be reported for June.

Production in Important Basic Industries Shows Slackening: April Output of Cotton Goods, Woolens, Copper, and Paper Show Signs of Passing Peak. See Fig. 4.

The production of copper has been relatively heavy compared with the total demand. Domestic consumption of copper has been large, but exports have decreased on account of the situation in Germany, which country is a heavy consumer. Accordingly, the price of copper has been somewhat weaker than it was in the early part of April, although very lately it has become slightly firmer.

Wool consumption in March was very little lower than that in January, but latest indications are that the April consumption decreased considerably. Reports to the Census Bureau from 968 woolen manufacturers operating 1146 mills show a decline in activity in wide looms and carpet and rug looms. The activity of spindles, cards, and combs, however, was greater in April than in the preceding month. A somewhat better tone is reported in the wool market, although mills are still buying in small quantities. The new domestic clip in the West is being bought very slowly as buyers consider the growers' quotations too high.

The April decline in cotton consumption was largely seasonal. In May 620,965 bales were consumed. This is 2140 bales less than the record March consumption. The number of active spindles

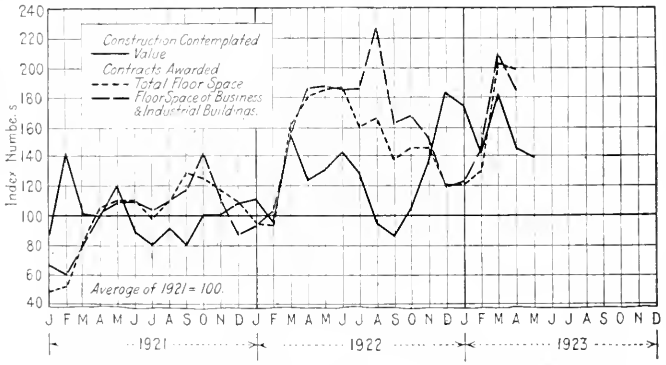


FIG. 6. BUILDING CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

Source, F. W. Dodge Company.

in May was slightly less than in April and considerably under March. High prices for raw cotton have caused sellers of cotton goods to hold more firmly, and warmer weather has improved the demand for cotton textiles. Cotton mills in New England are reported to have curtailed operations still further and activity in the finishing of cotton goods had slackened considerably in May.

The production of paper (all grades) appears to be somewhat greater than the usual seasonal decline.

The output of water power developed electricity (kw hr.) in April was the greatest recorded in the three years covered by the graph. If allowance were made for seasonal fluctuations the curve of electrical power would show a steady increase since September 1921.

The April figures on total production of electricity by public utility power

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
Index Numbers: Average for 1921 = 100

Month and Year	Gasoline*	Leather Cattle	Zinc	Newsprint Paper	Automobile Tires	Raw Sugar	Cotton-Seed Oil
	100 = 630,757,000 gals.	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,009 tons	100 = 4,361,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.
Jan 1921	89	100.7	52.2	82.5	126.2	55.9	107.1
Feb	93	102.5	98.4	108.0	121.9	54.5	114.1
Mar	92	102.1	101.1	130.5	119.0	86.1	140.9
Apr	92	102.5	104.9	139.3	105.3	76.8	144.2
May	104	100.8	103.1	117.0	103.7	164.7	146.0
June	103	101.4	108.4	104.0	102.0	196.5	130.8
July	109	100.5	116.4	88.7	95.2	170.0	117.3
Aug	108	99.5	119.7	85.0	89.2	106.1	89.4
Sept	109	99.5	112.1	90.4	90.2	97.4	61.0
Oct	102	96.4	105.1	100.8	76.6	93.8	34.2
Nov	102	95.9	91.7	76.7	81.2	48.9	46.0
Dec	103	95.2	86.8	77.1	89.6	18.9	74.2
Jan 1922	110	98.5	78.5	79.8	84.7	27.5	101.2
Feb	110	99.0	85.1	88.5	95.6	46.7	107.7
Mar	110	100.7	83.1	92.7	107.5	116.1	113.3
Apr	110	95.4	78.1	93.9	118.8	202.2	117.3
May	111	101.5	67.0	82.9	125.2	197.8	118.7
June	114	101.6	52.3	82.6	126.6	179.5	99.8
July	123	98.3	38.3	77.9	115.5	166.8	82.7
Aug	133	97.4	37.1	70.5	110.8	208.5	61.4
Sept	146	91.5	28.0	66.3	106.1	148.0	41.7
Oct	161	90.2	24.4	62.7	105.7	99.0	20.8
Nov	160	87.7	23.4	65.8	107.3	49.6	22.6
Dec	156	85.9	25.3	65.4	113.8	28.2	36.8
Jan 1923	156	85.3	23.6	64.0	105.4	15.8	57.0
Feb	154	84.0	21.5	76.7	107.6	40.2	77.1
Mar	162	82.6	14.1	77.3	119.7	73.4	88.6
Apr	164	81.6	13.0	67.2	129.9	184.3	93.9
May		81.4	11.6	62.9			
June			16.9				

*Last of month.

shows a seasonal decline for April, but the decrease is greater than that in either 1921 or 1922, the April figure of 605,490 tons being less than the February production which was not the case in either of the two preceding years.

Fuel and Power Output at a High Level. See Fig. 5.

In the accompanying chart the three curves taken together show the trend of use of the chief sources of power in the United States—coal, hydro electric power, and fuel oil. The coal figures have been adjusted to allow for the usual seasonal variation and consequently they represent increases or decreases in comparison with the usual production for the month reported.

The indicated consumption of fuel and gas oils in the United States is shown for 1922 and for 1923 through April. The maximum consumption in that period occurred in December 1922, when the consumption amounted to 933,000,000 gallons. Since then there has been a rather steady decrease to April, in which month the consumption was only 858,000,000 gallons. This decrease

plants show an average daily output of 149,300,000 kw-hr. which was 2 per cent less than the average daily output in March and about 3 per cent under the February rate which was a record breaker. This decrease in the daily rate of production is to be attributed to the usual seasonal decrease in the demand for electricity.

Accumulated Stocks of Goods in Manufacturers' Hands Show Diverse Trend.

Table 1 presents data in the shape of index numbers showing the trend of stocks in manufacturers' hands. The average monthly stock in 1921 represents 100 in each case. It is apparent at a glance that in three of the seven industries (gasoline, automobile tires, and raw sugar) the accumulated stocks in the latest month for which information is available are considerably in excess of the monthly average for 1921. In four of the industries the stocks are much less than the average for 1921 (leather—cattle, sole and upper—zinc, newsprint paper, refined cotton-seed oil). The stocks are notably small in the case of leather and zinc.

On the whole, the conclusion seems warranted that in most basic industries the situation as to stocks is not dangerous. Decided weakness appears only in the case of gasoline and automobile tires. The tendency is now towards price cutting in the tire business. As to gasoline, while the stocks are abnormally large, this is the season of maximum demand and petroleum products are firmly held by strong interests. The present strain in the petroleum industry arises from overproduction of crude oil, rather than from excessive stocks of gasoline. Heavy refinery stocks of raw sugar have recently caused a decline in the price of that commodity.

Building Activity Reached Its Peak in March: April and May Figures Show Decreased Building Activity Except in the South and Northwest—Contemplated Construction Falls Below Contracts Awarded. See Fig. 6.

A glance at the chart will show that contemplated construction, which is more

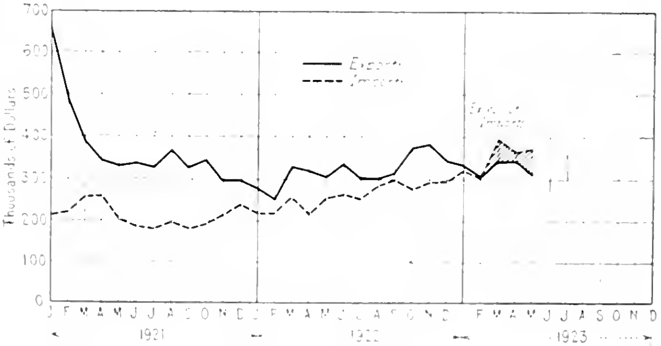


FIG. 7. FOREIGN TRADE IN THE UNITED STATES

Source, Department of Commerce.

sensitive to current and future developments, showed a marked decline in April and a further decrease of about 4 per cent in May. The total floor space of buildings contracted for fell off in April and probably also in May.

At present, it seems that the chief causes of the check on building activity is the advance in building costs. Large demand for iron and steel, the nonferrous metals, and various paint materials, to mention only a few commodities, has come from the great expansion of building. Railway tonnage and wages have been sharply affected by the same factor. If and when the building boom comes to an end there will undoubtedly be a tendency to decreased demand for materials and labor involved in a large number of industries.

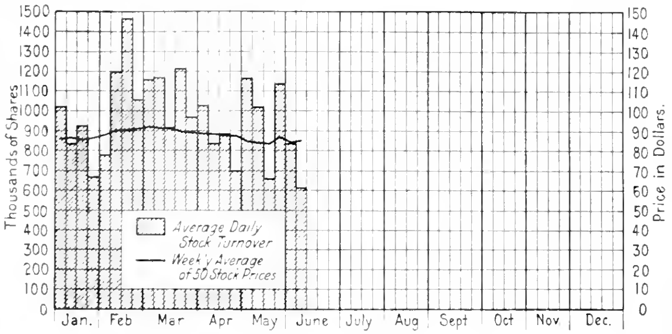


FIG. 8. STOCK TURNOVER AND PRICES ON NEW YORK STOCK EXCHANGE FOR 1923

Stock market indicates doubt as to future of business. Source, *New York Times.*

Trend of Trade and Finance

Unfavorable Balance of Trade Continues—April and May Imports Large While Exports Decline. See Fig. 7.

A glance at Fig. 7 shows that, for the first time during the period covered, the merchandise imports into the United States have exceeded exports. Since January 1921, the tendency has been towards this result. In that month the exports were more than $446,000,000 higher than the imports. The favorable balance between the two rapidly narrowed thereafter until February 1922, and since then only minor fluctuations have occurred. The conditions leading to the present situation appear to have reached a crisis about November 1922, and from that time exports of merchandise, measured in dollars, in spite of higher prices have shown a downward trend, while imports have moved upward. The two curves crossed in February and the result is a so-called "unfavorable balance"—indicated by the shaded area in the graph.

Imports into the United States during May are recorded at $370,000,000 while the export figure is $319,000,000, which leaves a merchandise trade balance of $51,000,000 against this country. The combined figures for the first five months of 1923 show an excess of merchandise imports over exports of $137,582,000. While this figure is not large it is significant as being the first time for many years that our exports have fallen below imports for three months in succession.

The causes of this situation are fairly easy to understand. The underlying factor is the relatively high level of prices in this country, when prices are put on a gold basis, together with the low purchasing power of Europe. When all prices are reduced to a gold basis it is found that Japan is the only nation of importance whose prices are higher than those in the United States. This situation finds expression in the fact that foreign exchange rates are low. As a result the United States has become an unfavorable market to buy in and a favorable one in which to sell. Normally we may anticipate a continuation of an unfavorable merchandise balance—or at least an unusually small favorable balance—until the prices and exchange rates become readjusted.

This readjustment will ultimately take place and will undoubtedly be accompanied by shipments of gold from the United States. Such shipments will tend to reduce the price level here in comparison with that in Europe. One result of such loans as that recently made to Austria will be to hasten this readjustment.

Prices and Money Situation Show Increased Business Strain: Wholesale Prices Down—Interest Rate Up When Allowance Is Made for Seasonal Variation. See Fig. 11.

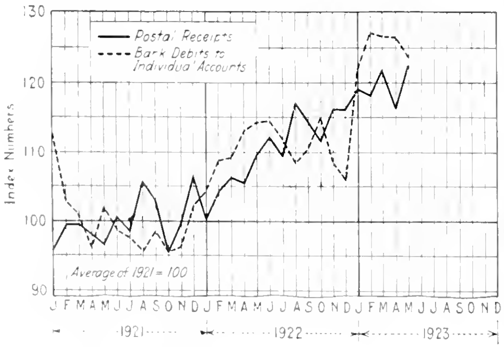


FIG. 9. BANK DEBITS AND POSTAL RECEIPTS

Corrected for seasonal variation. Sources, Federal Reserve Board; Post Office Department.

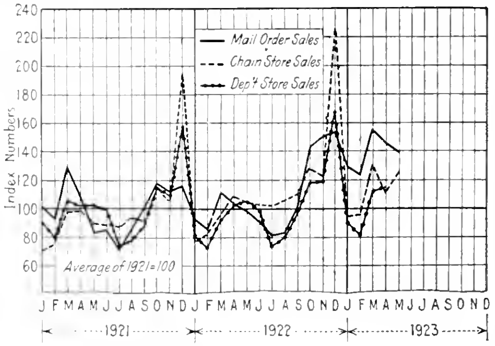


FIG. 10. SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES

2 Mail order houses; 4 chain stores; 306 department stores. Sources, *Commercial and Financial Chronicle;* Federal Reserve Board.

Probably the best known of the indexes of commodity prices, which [illegible] or any special purpose [illegible] by Bradstreet's. This index shows [illegible] the general level of wholesale [illegible] on June 1, was 45 per cent [illegible] 1913 average, and 17 per cent [illegible] 1921. The significant thing at the present time, however, is that there has been a considerable decline in this index the two successive months. On May 1, the price level was 1.80 per cent lower than on April 1, and by June 1, there was a further decline of 2.06 per cent.

The decline during May was very clear-cut in that only one group of products showed a gain, while 11 out of 13 showed losses. The one group to advance was building materials which increased about 1 per cent. The largest decreases occurred in the cases of naval stores, coal and coke, metals, breadstuffs, provisions, and livestock.

Bradstreet's index is based on 96 commodities. In order to secure a more sensitive indicator, the New York University Bureau of Business Research has constructed an index number based on six important commodities whose trend in the past has given evidence of forecasting the trend of business. (These commodities are pig iron, copper, sheetings, silk, cotton-seed oil, and wheat—the last being adjusted for seasonal variation. The average prices for the month are used.) The trend of this index number has been rather similar to the other, but its fluctuations have been somewhat greater and it reached a higher point in March. The six-commodity index was 36 per cent above the 1921 level in March, remained unchanged in April, and declined to 30 per cent above that level in May. The downward trend of this index is believed to be an important indication of a less favorable outlook for profits in business.

[illegible] compared [illegible] on [illegible] commercial paper [illegible] during the past two [illegible] due to the [illegible] seasonal variation [illegible]

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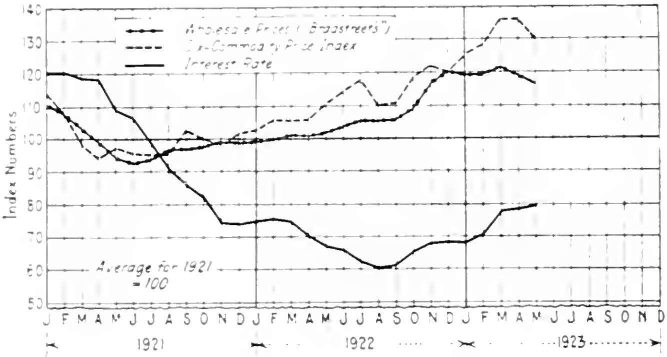


FIG. 11. WHOLESALE PRICES AND INTEREST RATE

Corrected for seasonal variation.

The Wage and Employment Situation

Upward Trend of Labor Earnings Continues: Average Earnings of Labor Increase More Rapidly Than Cost of Living. See Fig. 13.

In spite of the failure of employment to increase appreciably in April the average weekly earnings of laborers continued the upward trend of the last 16 months. In April the weekly earnings of laborers of all sorts on the average were higher than at any time during the last two years. The latest reports for May state that 287 wage advances occurred; no decreases were recorded. Over half the advances occurred in the building trades and building materials and in the clothing and textile trades.

The index number of average weekly earnings in New York factories reached a minimum in November 1921, while the average weekly earnings in the selected industries reported to the United States Bureau of Labor Statistics was at its lowest point in January 1922. Since those dates there has been a practically unbroken increase in the average earnings of labor.

A striking fact is that in April 1923, the average earnings of both New York factory workers and the laborers in various representative industries covered by the United States Bureau were practically identical with those in January 1921.

During the period covered by the chart the general trend of cost of living as reported by the National Industrial Conference Board has been downward. The index number shown in the chart is based on the average for 1921 as 100. On this basis, the index of cost of living was 108.5 in January 1921 and 95.4 in April 1923. It follows from these facts that in April the average weekly earnings of labor were much higher in relation to cost of living than in any month during the period covered. The cost of living index reached a minimum in August 1922, when it was reported as 92.6 (on the basis of the average month in 1921 equals 100). Since then, that

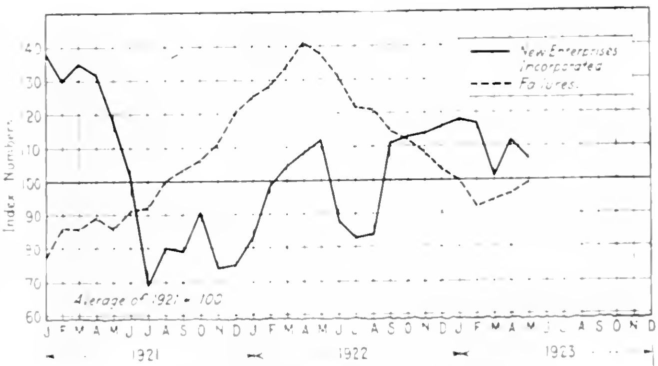


FIG. 12. BUSINESS FAILURES AND NEW ENTERPRISES

Adjusted for seasonal variation, 3 months moving average. Sources, *Dun's Review*; *New York Journal of Commerce*.

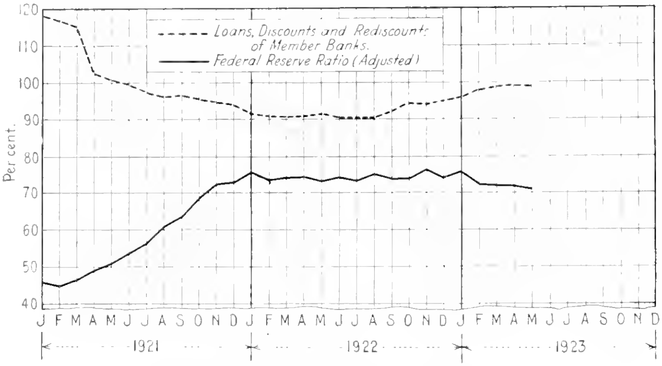


FIG. 13. BANK CREDIT AND FEDERAL RESERVE RATIO

Ratio = total reserve to note and depos. liab. Source, Federal Reserve Board.

index has risen approximately 3 per cent. During the same time the average weekly earnings in the selected industries covered by the United States Bureau of Labor have increased 12 per cent and the average weekly earnings of New York factory laborers have increased 9 per cent.

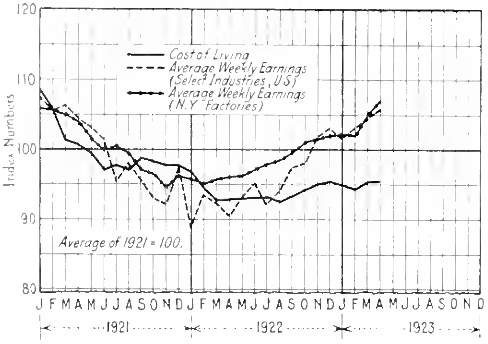


FIG. 14. WAGES AND COST OF LIVING

Sources, Bureau of Labor Statistics; New York State Department of Labor; National Industrial Conference Board.

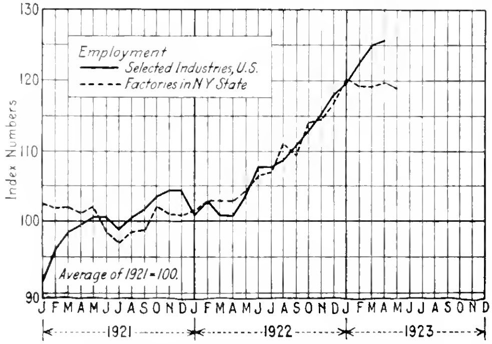


FIG. 15. THE TREND OF EMPLOYMENT

New York Curve corrected for seasonal variations. Sources, Bureau of Labor Statistics; New York State Department of Labor.

Lest it be thought that the cost of living index of the National Industrial Conference Board is affected by bias, attention is here called to the figures of the United States Bureau of Labor Statistics which deal with this subject. They show that cost of living advanced only a little over 1 per cent between September 1922, and March 1923. Moreover, the advance in retail food prices between August 1922, and March 1923, was less than 1 per cent. The Bureau of Labor's figures practically coincide with those of the Conference Board and amply support conclusions based on the researches of that organization in this field.

Two conclusions are plain: (1) The earnings of labor have lately increased more rapidly than cost of living and have continued upward after a decline in wholesale prices; (2) in view of the recent decline in business activity the earnings of labor cannot continue to advance much longer, unless business picks up again, without seriously affecting profits and reacting unfavorably upon the whole industrial structure.

As long as prices advance, proportionate increases in wages are, as a rule, desirable. When prices decline, continued wage increases generally tend to favor labor at the expense of other classes.

Upward Trend of Employment Checked: Number of Laborers on Pay-Roll in Wide Range of Industries Remains Practically Stationary in April. See Fig. 15.

The United States Bureau of Labor reports changes in the number of laborers on the pay-rolls of a group of 43 selected industries. The New York Industrial Commission reports the trend of labor employment in factories in New York State. Index numbers showing the results of these reports have been computed and are shown in the accompanying graph. In the case of the New York State figures the normal seasonal variation has been eliminated.

Aside from the steady increase in employment during the year 1922, the salient feature of the chart is the check to that increase which the later figures show. The index for the United States in April was practically the same as that for March. The April figure was 125.6, indicating an increase above the average level for 1921 of over 25 per cent. The index number for New York State declined in February, since then it has risen but slightly, reaching 119.7 in April—nearly 20 per cent over the average for 1921.

The significance of these recent changes in the trend is not clear. It may be that employment conditions are merely becoming stabilized. In view of the general decline in forward orders it does not seem likely that a general increase in employment will be resumed in the near future. There remains the possibility that a decline may follow.

One fact which the chart makes clear is that the upward trend of employment of factory labor in the northeastern section of the country was checked much earlier than was the case with employment in the wider range of industries covered by the Bureau of Labor's reports.

May Employment Sets New Record: Decreases in Some Industries More Than Offset by Big Gains in Others—

Signs of Labor Shortage in Most Parts of the Country. See Figs. 16 and 17

Unemployment was less common in May than at any time during the last twelve months, according to the United States Employment Service. In most sections of the country there is now somewhat of a labor shortage, although this is most pronounced in the case of farm labor. The rapid migration of negroes from the South has caused some anxiety in that section concerning the labor supply.

The report states that in New England industries are generally working on a full time basis with labor shortage existing at various points. There is practically no unemployment in the New Jersey and Pennsylvania section, with shortage existing in the steel district and in farming sections. In New York State, employment has been stimulated by accumulated orders, principally in the iron and steel trades, automobile industries, and the manufacture of machinery, railway equipment, and building materials. Building operations are heavy in most parts of the state and available building mechanics are fully employed, with shortages in several cities. There is active demand for labor in foundries.

In a general way the reports from the Middle West and West indicate full employment in practically all lines, with shortages in the agricultural districts.

The accompanying graph, Fig. 17, shows the trend of employment and earnings for April in some of the chief industries. The only decreases in employment shown in the chief industries are in cotton goods, boots and shoes, and slaughtering.

Late information is to the effect that May figures will indicate a similar trend. The United States Employment Service reports general increase in employment of 0.39 per cent. Increases in May occurred in the following industries: iron and steel; stone, clay and glass; liquor and beverages; paper and printing; land vehicles; and chemicals. There was a decline in May in a number of industries including leather and leather products, lumber and its manufactures, tobacco manufactures, food products, textiles, non ferrous metal and its products, and railway repair shops.

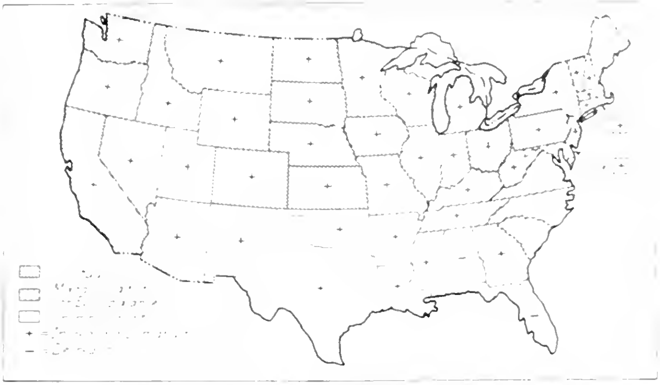


Fig. 16. Conditions of Emplo[illegible] April [illegible]

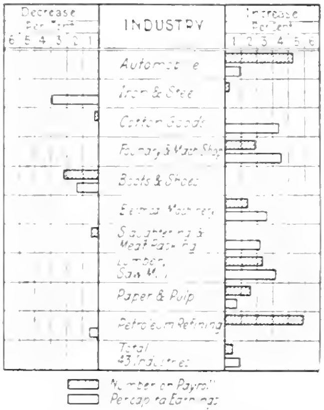


Fig. 17. Trend of Employment and Earnings, April 1923

Source, Bureau of Labor Statistics.

Balance of Immigration More Favorable to Labor Supply: Emigration Declines—Drop in Number of Immigrants Checked. See Fig. 18.

In view of the widespread shortage of labor the relation between immigration and emigration has much importance. The chart dealing with this subject shows the situation clearly. Throughout the greater part of 1922, the situation was improving, with immigration rising from February to October and emigration remaining steady at a rather low level. In the fall of 1922, however, the situation became more threatening as regards the labor supply of the country. Immigration fell off sharply till January 1923, and there was a sharp increase in emigration in December.

The latest official figures available for a complete month are those for April, and these seem to indicate that the unfavorable trend has been at least checked. In February the number of immigrants increased from 28,717 (the January figure) to 30,118. At the same time, the number of emigrants fell from 4232 to 2749. As the February trend has been continued in the figures for the succeeding months, the unskilled labor situation may be somewhat improved.

The following table will show the net trend of migration during this year.

	Immigration	*Emigration*	*Net Immigration*
Jan	28,717	4,232	24,485
Feb.	30,118	2,749	27,369
Mch	53,330	10,630	42,700
Apr.	52,433	4,509	47,924

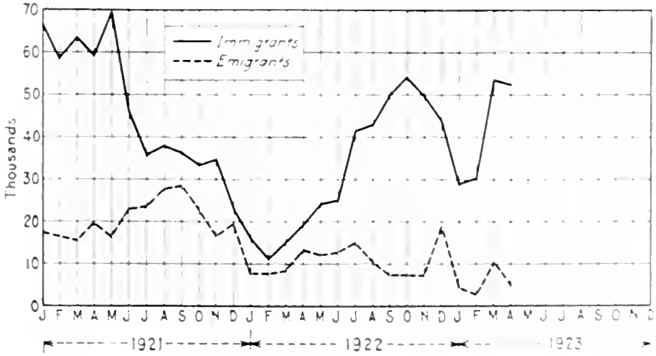


Fig. 18. Immigration and Emigration

Source, United States Bureau of Immigration.

CURRENT BOOK REVIEWS

JOB ANALYSIS AND THE CURRICULUM

By Edward J. Strong Jr. and Richard S. Uhrbrock
146 pp. Williams and Wilkins

REVIEWED BY F. A. SILCOX*

THE fundamental purpose of the book "Job Analysis and the Curriculum," by Prof. Edward J. Strong Jr. and Richard S. Uhrbrock, is to work out a curriculum based on a scientific definition of the exact character of the jobs which are to be filled. Without definition there can really be no competent demonstration. Clearly, the two writers have pointed the way to a new approach in the construction of a curriculum designed to train students as executives in a particular industry. What the student will have to do in practice if he becomes an executive in a printing plant, is arrived at by finding out first what the printing executive in the average printing plant actually does.

The investigators have shown that it was quite possible to define the way in which the average printing plant is organized, and by carefully planned job analysis to determine what character of executives are needed and what their functions are. Upon this information as a foundation, they proceed synthetically to build up the courses of instruction that will best meet predetermined, well-defined needs.

It is quite apparent from the job analysis that the duties of the executive in any commercial printing plant are in large measure similar to those of the executive in any production plant, whether it be printing, textile, shoe manufacturing or what not. In other words, it would seem quite clear, judging by the curriculum finally worked out after the detailed job analysis, that about 75 per cent of the courses of training outlined would have to be given to students who desire to become executives in any industry. However, the especially valuable contribution made by this book is that it defines with selective discrimination, based upon scientific analysis, just what the other 25 per cent of the course should be to train the printing executive as distinguished from the executive in another industry.

Someone has said that 85 per cent of all business processes are the same, and 15 per cent special technique. In other words, if an executive understands the basic structure of industry—legal, financial, distributive, industrial relations, buying, production and the like—he can function in any industry. The detailed analysis made by Professor Strong and Mr. Uhrbrock to a great extent substantiates this general statement, although a critical check of the courses included in the curriculum indicates that the percentage of courses covering technique of the printing industry runs higher than 15 per cent. In the first year specific technical printing subjects—sketching and design, hand composition, platen presses—constitute 18 hours out of the total of 112, or 16 per cent; in the second year, printer's English, sketching and design, machine composition and cylinder presses, constitute 38 hours out of 112 or 34 per cent; in the third year, printer's English, printer's cost accounting, typography of advertising, estimating, bindery and photography, constitute 32 hours out of 112 or 29 per cent; and, in the fourth year, engraving, electrotyping, lithography, and related processes, shop organization and management for superintendency of printing, 27 out of 105 hours, or 26 per cent.

The other elements of the curriculum are such subjects as English, psychology, chemistry, physics, general accounting, shop management, economics and the like. These subjects form the 70 to 75 per cent background of an understanding of industry as a whole to which the students can relate the 25 to 30 per cent of technical training which is incorporated in the curriculum. The course seems to be admirably balanced to give the student an understanding of industry as a whole, and of the printing industry and its technical processes to equip him for the profession of a management executive. The course does not aim to equip him as a skilled workman in any particular branch of the industry, but to insure his appreciation of what constitutes good work executed by a skilful mechanic.

The writers of this book are to be congratulated upon the excellent piece of work they have done. They have made a real contribution, which should stimulate a scientific approach to the problem of training students to assume responsibilities as executives in the printing industry. It would be a good thing if every executive manager in the printing plants should read this book and then carefully examine the operations of his own plant, and, if possible, open the way for supplementing the training of his executives along the line suggested by the curriculum based upon competent job analysis.

* Director, Bureau of Industrial Relations, New York Employing Printers' Association.

APPLIED BUSINESS FINANCE

By Edmond E. Lincoln. 772 pp.

A. W. Shaw Company.

REVIEWED BY FRANCIS OAKEY*

ONE of the chief needs of the business world has been and still is a widespread knowledge of sound methods of financing. Much thought has been given to production, selling, distribution, and other important functions of business, but financing is a subject that receives comparatively little attention until financial embarrassment occurs. A comprehensive, up-to-date and authoritative work on this subject has been needed.

Professor Lincoln's book entitled "Applied Business Finance" meets this requirement and, if widely dis-

* Recently General Auditor, Federal Reserve Bank of New York; Member of the Firm of Searle, Oakey and Miller, Public Accountants, New York.

tributed, should do much to bring about right thinking not only by the business man but by the banker and investor. It is evident that this book has been the result of the most painstaking research; it covers a difficult subject comprehensively and in detail, presents clearly every form of financing, describes the various methods by which capital is obtained, and explains the advantages and disadvantages of each method. It states the relationships of financing to the business cycle, and to organization.

One of the best chapters in the book is "Shall the business be launched?" This question is seldom answered intelligently. The chapters on the instruments of long-time finance and the methods of raising long-time capital present a thorough treatment of the various kinds of stocks, bonds, and notes commonly issued, and may be read with advantage by the investor as well as by the corporate officer or director. The methods of dealing with the commercial bank, the investment banker, and the commercial paper house are explained in detail. A very useful chapter is that on the use of acceptances; the distinction between the trade acceptance and the banker's acceptance is very clearly stated. The significance of financial statements is explained with particular reference to terminology.

One hesitates to criticize such an excellent piece of work as Professor Lincoln's book, but the reviewer believes that the chapters on purchasing, producing, and selling might be omitted without detriment to the work. These subjects have been treated so comprehensively and in such detail by other authors that they need hardly be included in a book on finance.

To sum up the views which have been expressed in the reviewer's opinion, "Applied Business Finance" is a distinct contribution to the literature of business, and the author is to be congratulated for his comprehensive, accurate, and sound treatment of an exceedingly difficult subject.

FARM MORTGAGE FINANCING

By Ivan Wright

[illegible] pp. McGraw Hill Book Company, Inc.

REVIEWED BY FRANK A. FALL*

INSCRIBED "to indebted farmers, mortgage bankers, and investors," this book, a companion volume to the same author's "Bank Credit and Agriculture," is intended to present the important facts concerning modern methods in the farm mortgage business. It consists of 17 chapters of text, a bibliography covering French, British, German, and Italian as well as American publications, and some 76 pages of appendices, some of which might logically have been included in the chapter text.

One of the most valuable chapters is the fourth, describing the Federal Farm Loan System. It covers the organization of the Board and of the Federal Land Banks; the chartering of Farm Loan Associations and the procedure by means of which farmers secure loans. Limitations on the use of money borrowed through the Federal Land Bank are clearly stated. As specified in Section 12 of the Federal Farm Loan Act, [illegible] acquired may be used only to provide for the purchase of land for agricultural uses; for equipment, fertilizers, and live stock necessary for the proper operation of the mortgaged farm; to provide buildings and improvements; and to liquidate indebtedness of the owner of the land mortgaged, existing at the time of the organization of the first local farm association established in or for the county in which the land mortgaged is situated.

Other chapters take up the relation of life insurance companies, national and state banks to farm mortgages; legal and other problems of trustees and estates; the taxation of mortgage credit; the marketing of farm mortgage securities and the economic valuation of farm land. This volume and the author's "Bank Credit and Agriculture" together cover the most significant phases of agriculture credits, and will doubtless find wide use for textbook purposes in colleges and universities which attempt to cover the field of agricultural finance.

* Associate Editor, MANAGEMENT AND ADMINISTRATION.

DEPRECIATION PRINCIPLES AND APPLICATIONS

By Earl A. Saliers, Assistant Professor of Accounting, Yale University. 590 pp. The Ronald Press Company

REVIEWED BY JAMES P. ADAMS*

THE title "Depreciation Principles and Applications" is not suggestive of the whole of the subject matter of this valuable addition to accounting literature. The body of the work is divided into three parts: (1) General Principles; (2) Depreciation and the Income Tax; (3) Depreciation and Public Utility Valuation. One hundred and fifty pages of appendices furnish an elaborate study of depreciation accounting practice, with special reference to depreciation rates, and constitute a valuable handbook of depreciation experience.

The author gives depreciation accounting a setting as a part of the general problem of marking the distinction between capital and income. A complete depreciation terminology is presented and explained. The author's views on functional depreciation are shown by the following quotations:

> Inadequacy is a question of size and power while obsolescence is one of type and quality. (Page 22.)
>
> A machine should not be replaced until it is really obsolete; it is not obsolete until its written-down value can be added to the cost of a new machine and yet enable production to be carried on at a lower capital cost than with the old machine in operation. (Page 21.)
>
> But the writer believes that no reserves of any kind are necessary or desirable for the proper handling of obsolescence and inadequacy, because the cost of a unit of plant should be written off by means of a charge to depreciation based on the natural physical life of such unit; and where such rate does not cover cost due to shortening of useful life from obsolescence or inadequacy the uncovered cost or cost not returned through such normal depreciation rate should be added to the cost of replacement and written off over the natural physical life of the new unit. (Page 27.)

* Assistant Professor of Economics, Brown University, Providence, Rhode Island.

Since every dollar of investment should be charged against output, it is reasonable that cost of scrapping machinery not yet worn out be charged against the output of the period which gets the benefit of the more economical machinery. (Page 33.)

. . . to charge obsolescence to the period preceding the time when the property actually becomes obsolete is in effect to say that since a new invention made in the future will greatly cheapen production we shall burden the present period not only with its due proportion of accruing expenses but we shall also add to such expenses the cost of scrapping good machinery in order to make way for machinery which will give still cheaper costs in the future.

This discussion involves four problems: (1) When is machinery obsolete? (2) When should obsolete machinery be abandoned? (3) How should obsolescence be treated in the accounts? (4) How does such abandonment affect prices of future product? The first is a mere matter of definition. In view of ordinary usage, a machine would seem to be obsolete when one of improved "type and quality" (as measured in a lower cost per unit of product) is put on the market *regardless of the present advisability or inadvisability of substitution.* The author very properly indicates the basis for a decision to substitute the new machine. *Whether the loss from abandonment can be recouped or not,* substitution, in so far as influenced by future unit costs, would be economical only under the conditions outlined. Whether, as a matter of accounting practice, the unrecovered cost of the abandoned machine should be capitalized and charged against future earnings is another matter. Four possible treatments suggest themselves: (1) the inclusion of an allowance for possible obsolescence within the annual depreciation charge; (2) the capitalization of uncovered cost of abandoned machine as suggested by the author; (3) the provision for obsolescence as a part of a general policy of conservatism through reserves for contingencies; (4) charging the past through the surplus account at the time of abandonment. The reviewer believes that either of the last two methods is proper. Certainly something can be said of the impropriety of burdening the future users of a service with the capitalized shortcomings of the past *even if that were possible.* Under such circumstances such future users would hardly reap the "benefit of the more economical machinery" referred to. They would gain very little from advancement in the arts if what is saved in the costs of machine operation is made up for by larger capital costs (including uncovered depreciation on abandoned property). But can such losses always be recouped? Can such "cost of scrapping machinery not yet worn out be charged against the output of the period which gets the benefit of the more economical machinery?" It is agreed it can be *charged;* that is a matter of *accounting* for fact. But can this loss be recouped in the price of future product? In competitive industry the possibility of any such price adjustment depends upon the potentiality of competition of concerns not so burdened by abandonment losses.

The author emphasizes three reasons for giving accounting recognition to the depreciation problem: (1) to preserve the capital investment; (2) to insure that the cost of a property unit "is properly spread as a cost of production or service over its lifetime;" (3) to "provide directly or indirectly the money required to make the replacement of worn-out or abandoned parts of plant." The significance of depreciation accounting for the determination of specific values for balance sheet purposes is not mentioned although its relation to public utility valuation is given careful consideration. Much confusion could be saved by a careful consideration of the sound accounting doctrine contained within the following quotations:

Depreciation, from the accounting point of view, deals strictly with the question of the replacement of wasting assets at cost. (Page 47.)

The purpose of the depreciation is to bring the effects of depreciation expense into the accounts in such a way that it will be charged when it occurs. It is not the purchase of an article which justifies charging it to the consumer, but its use in producing something which he buys. . . . No single error has caused more misunderstanding than the confusion of replacement cost with depreciation expense. (Page 78.)

Depreciation reserves are called "valuation reserves," because of their peculiar relation to the assets whose depreciation they measure. . . . Their sole purpose is to record accrued depreciation and to make it possible at the same time to retain in the ledger the cost of the assets whose depreciation they record. (Page 74.)

Although the depreciation reserve preserves invested capital by the retention of revenue, future replacements will be made out of general funds unless some special provision is made to accumulate money for that purpose. . . . The retention of sufficient funds, by means of the depreciation charge, is the essential step. (Pages 80-81.)

Chapters VII and VIII, bearing the ill-considered title "Methods of Depreciation," contain a detailed analysis of *methods of measuring depreciation.* The arrangement of material is unfortunate. A general critique of the various methods precedes their detailed explanation, and forward references, always unsatisfactory, unduly burden the reader. The methods themselves receive very careful consideration. Detailed explanations are accompanied by tables of computations, graphic illustrations of the course of the depreciation process, and mathematical formulæ for the calculation of the charge. The author calls attention to the estimate character of the whole problem and recommends the use of the "straight line method." The weaknesses of the more "complicated" methods involving interest calculations are pointed out. The "Annuity Method" and the "Equal Annual Payment Method," as described are both based upon the desire to include, as a charge against revenue, an item of interest on capital investment unreturned. The author very properly challenges the inclusion of such interest as a cost and, secondly, its inclusion under the cloak of depreciation. Unfortunately the accounting entries for these methods are not shown. The author does state that, in the case of his equal annual payment method, the depreciation charge would be "what the charge for a sinking fund would amount to for the period in question, plus a sum representing interest on the remaining investment." (Page 137.) The credit must necessarily be to the depreciation reserve for the first of these amounts and to an Interest Income account for the balance. It does not, then, amount "to a retention of a portion of the profits in the business without recognizing them as such.'' It constitutes a shifting of what would otherwise appear as a manufacturing, or trading, profit to an income account.

The second part of the book is devoted to a study of depreciation and its relation to income taxation. An historical analysis of the development of the ''income concept'' in legislation, and its judicial interpretation, paves the way for a discussion of specific administrative policies.

The third part of the book is devoted to the study of a highly controversial subject, depreciation in relation to public utility valuation. The first chapter furnishes a background for a detailed analysis of the problem. Public utility valuation is recognized as a phase of public utility regulation.

> Government interference and control is essentially a financial problem . . . based on the theory that there exist certain concepts of an accounting character which can be defined with enough accuracy to enable us to base policies and plans of procedure on the results which are secured by means of the application of accounting principles. (Pages 320-321.)

Federal and state experience in the regulation of accounts, with special reference to depreciation accounting practice, is described. The development of the ''fair value'' doctrine, the purposive character of valuations, and the methods of specific valuation projects are outlined in detail. The important valuation bases, ''actual cost,'' ''reproduction cost,'' and ''market value,'' and their relation to rate-making, capitalization, taxation, and public purchase, are analyzed critically.

But the author is concerned here with *depreciation* in public utility valuation.

> In a large plant where the replacements are sufficiently numerous to spread the charges against the reserve evenly over successive periods the reserve undergoes a steady growth, but at a constantly diminishing rate, until the plant arrives at a condition of normal depreciation, after which the reserve remains stationary because abandonments offset reservations. (Page 415.)
>
> The amount reserved is definitely the property of the company returned through the rates to offset accrued depreciation on plant but which has not been deducted from cost. If the accrued depreciation were deducted from cost of plant in determining fair value then . . . extensions financed out of depreciation reserves ought to be included in fair value. . . . When revenues have not been sufficient to afford a fair return and also to establish depreciation reserves, so that no reserve has been set up [accrued but unearned depreciation should not be deducted in fixing fair value]. When revenues have been sufficient to afford a fair return and also to establish depreciation reserves, but no reserve has been set up . . . depreciation has been earned but distributed, it should be deducted from cost in determining fair value. When the reserve is employed to amortize capital . . . depreciation should be deducted in determining fair value. (Pages 418-419.)

This analysis should do much toward clearing up the seemingly hopeless conflict of opinion concerning depreciation in public utility valuation. The author has made a distinctly valuable contribution to the literature of a very important phase of accounting theory and practice.

AMERICAN RAILROADS

By William J. Cunningham

409 pp. A. W. Shaw Company

REVIEWED BY J. A. DROEGE*

THERE are authors and authors. Much of the interest in a book, or a lecture, depends on the equipment, the experience of the author or lecturer. The author of ''American Railroads'' possesses unusual qualifications; he has been ''through the mill,'' having spent his earlier life in actual railway work. He lectured on railway subjects at Harvard as incidental work, and reversed the process when as a professor he carried on railway accounting and research work as a side issue, later and now filling the James J. Hill chair as Professor of Transportation of Harvard University's Graduate School of Business Administration. During the period of federal control, he was detached and placed in charge of the Operating Statistics Section, afterward serving as Assistant Director of Operation. His book records essentially the reasons for and results of federal control of our railways.

Professor Cunningham concisely, entertainingly, and without the use of personal pronouns—too common with many railway writers—tells of the unfavorable change in the curves of operating costs and operating efficiency about 1887 when we first heard of governmental regulation, accentuated in 1906 with the passage of the Hepburn Amendment to a more decided upward and downward trend respectively, and he points out the significant fact that by 1915 more than 80 roads were in the hands of the courts. He tells the story comprehensively of the United States Railroads during and following the period of the World War and, notwithstanding the all-inclusive title of the book, hews closely to his text. We wonder why some writers on more or less specific railway subjects—usually well-covered—select such broad titles as ''American Transportation Question,'' ''Principles of Railroad Transportation,'' ''Railroad Administration,'' ''American Railroad Problems,'' ''Regulation of Railways,'' ''Railroad Freight Transportation.'' Any one of these fully and properly treated would mean a minimum of a 5 foot shelf. One of the latest of these books is exceptional in that it really does attempt to cover nearly every phase of railroad history and operation and meets the problem about as successfully as the proverbial kimona which covered everything and touched nothing. The author of ''American Railroads,'' however, meets and covers that part of the subject he has undertaken. He brings out clearly the significant fact that the Interstate Commerce Commission recommended supervision of laws during the war—the laws that compelled the roads to compete and prohibited pooling of facilities and earnings. He freshens our memory by quoting, along with other important orders, that of Director General McAdoo, January 5, 1918: ''Every patriotic citizen can directly help . . . by refraining from all unnecessary travel at this time,'' and the later supplementary request of Theodore H. Price of the Director General's personal staff urging the public to ''Stay at home . . .''.

* General Superintendent, New York, New Haven & Hartford Railroad Company.

as a patriotic duty." He tells of the heavy curtailment of passenger train service generally, both ordinary and so-called "luxury;" the widespread freight embargoes with the liberal use of permit system and priority orders. A characteristically readable story of the origin of the National Agreements, the abolition of piece-work in the fall of 1919 (the real inception of the Shopcrafts strike of the last half of the year 1922) is told in Chapter XVII, under the title "Post-War Labor Policies." An authoritative recital is included, telling how the classified employees forced the issue by a strike threat, while the nation was at war; how the Director General met the situation and cleared the atmosphere by prompt assurance of immediate and sympathetic attention, increases in wages when made to be retroactive to January 1, 1918, and by the further assurance that the Director General's "cabinet" would include, as Director of Labor, the chief executive of one of the railroad labor unions. A quotation from F. H. Dixon's "Railroads and Government," inserted at this point, characterizes the desire of these employees to perpetuate their gains under private operation as "no more than human." The author expresses the opinion, without reservation (page 134), that "the results achieved under federal control during 1918 were more favorable than would have been possible under a continuation of private control." While there are those who might take issue with this statement, his courage in making it is admirable, and he is on safe ground.

The general record made in handling of troop movements is detailed (pages 127-128). This prompts the thought that possibly in a small way, with little to do with, wholly inadequate facilities and lack of preparation, some of the achievements during the Spanish War, 1898, might be compared. A clean-cut denial is formed from this authoritative and dependable source (page 272), that during the war period, railroad officers conspired to increase costs and otherwise discredit governmental operation or that interlocking directorates controlled purchasing agents. These canards are the logical and natural offspring of the Plumb plan of nationalization. With the author's ripe experience and discerning ability, he could have elaborated considerably, and added materially to the general knowledge of railroad conditions, by giving his personal opinions on the trend of events. The chasm between the policies of Arthur and Stone is wide; the period a short generation. It is disturbing to note the present-day teachings of the leaders of the one organization we have always fondly regarded as dependable, as a bulwark of conservatism and a torch-bearer to others. It is reassuring to find, on the other hand, the "freshman" organization, of the four dominating train-service operations, faithfully following an old, experienced, successful, time-tested leader who candidly and courageously preaches old-time patriotism to his government and loyalty to employer; and who vigorously takes both the railway manager and the train employee to task, tells them to discontinue abuse and criticism of each other and to get back to erstwhile methods of "scrapping it out in our own backyard," and combine for the good of the common cause. He recognizes that service to the public is of paramount importance; quite the reverse of the policies of the leaders of the older organizations. The author of "American Railroads" can contribute much of value to this question. He does see something like a coming rainbow (Chapter XVIII, page 287), following his statement that "This state of affairs cannot continue" by reassuring us that the national conscience will gradually reassert itself; that class consciousness will be less apparent; that the acute strife will lose its bitterness and, while the respective viewpoints will always be different, much of the present distrust and antagonism will eventually yield to the spirit of fair play. In this same chapter he points out (page 280) the unfortunate effect of inherited federal control agreements, impelling railway officers to follow the lines of least resistance, contrary, in many instances, to their better judgment, and he clearly shows the result on the rank and file of the subordination of merit to seniority in minimizing the incentive to excel and opportunity of the management for organizing promising material for managerial understudies.

BUILDING YOUR OWN BUSINESS

By A. C. Burnham

282 pp. The Ronald Press Company.

REVIEWED BY CHARLES BLAUVELT*

THIS book, which grew out of the actual business experiences of the president of the Brodie Burnham Company of Chicago, and of some 50 other men who brought their own enterprises through from small beginnings to unquestioned success, is an admirable example of the "How" books that are now in such urgent demand among business men and women, from the lowest rung of the ladder up to the top.

The reason for the urgency and the steady continuity of this demand is not difficult to discern. Men and women who wish to know how to accomplish a certain result rate very highly the testimony and the advice of one who has actually done the trick himself and can describe the process step by step from his own experience. Mr. Burnham is such a man, and his book has a definite, vital message for everyone who looks forward to the time when the status of employee will be abandoned for that of the independent control and management of a business enterprise.

Mr. Burnham's order of development is logical. He first discusses in clear-cut, practical terms the method of discovering an idea on which a successful business enterprise may be based. He then suggests how the idea may be tried out, warning the reader that the pitfalls surrounding a new business, starting with limited capital, are so many that wisdom demands a thorough test of the idea before one ventures too far into a new proposition. The next steps are the planning and organizing of the business, the financing of it, and finally the best methods of actual operation.

In the chapter entitled "How to Finance a Small Business," Mr. Burnham quotes the familiar incident concerning the elder J. Pierpont Morgan, who testified before an important Congressional committee that in his experience as a banker he had found character in the borrower to be the first and most important factor

* Secretary-Treasurer, Okamoto and Co., Inc., New York.

to be considered in making a loan. Mr. Burnham wisely qualifies that point of view by stating that bankers are not altogether altruistic nor are they in business from purely philanthropic motives, and all the character in the world will not get the new man a loan without some other security.

Mr. Burnham's generous number of illustrative cases are well selected, intrinsically interesting, and soundly generalized upon in each instance. For every man who sees the present wealth of opportunities for small business concerns (and only a blind man does not), this book comes very close to being indispensable.

MONETARY RECONSTRUCTION

By R. G. Hawtrey. [illegible] pages
Longmans Green and Company

Reviewed By Thomas York*

As its title suggests, this volume deals with the problems created by the European monetary demoralization, but if the reader expects to find a systematic and unified treatment of the subject he will be disappointed. Instead he will have before him a collection of half-a-dozen independent essays written at various dates during the last seven years and arranged chronologically. The essays are reproduced practically intact in their original form.

There is naturally much, especially in the earlier essays, that is obsolete and of little interest to the students of the prevailing state of monetary affairs in Europe. In fact, there is not a little error to be found in them, largely because some of the author's predictions failed to materialize. However, some of these mistakes are corrected in a rather lengthy introduction by means of which the author also attempts to give some semblance of unity to the compilation.

This method of composition, convenient as it may be for the author, is not a little trying to the reader. The first chapter or essay, for example, is entitled "The Fall in American Exchange" (incidentally, this should be "The Rise in American Exchange") but as one turns to it he finds that instead of reading about the fall of the sterling rate during the past few years, he is carried back to the summer of 1915, at which time sterling underwent a relatively small decline when viewed in the light of more recent events. Similarly, the second chapter is named "Inflation," but the reference is not to the highly aggravated form which inflation assumed during the latter part of the war and since, but to its incipient stages in 1916, in which year the essay was written. However, the reader is warned of all this in the introduction, and he would not be ill-advised if he simply passed over these first two essays, since whatever of value they may contain is later repeated with much better effect in the subsequent essays.

These later chapters are entitled, respectively: "The Gold Standard;" "The European Currency Situation;" "The Federal Reserve System of the United States;" and "The Genoa Resolutions on Currency." Appearing in the years following the war, they have a far more timely bearing on the present monetary situation in Europe than the first two chapters, and the reader, even if he dissents from some of the writer's main propositions and conclusions, as he very well might, will nevertheless discover in these last four chapters a great deal that is both suggestive and informing.

For example, in the essay on our "Federal Reserve System," the author makes this illuminating remark concerning the usual contention that the federal reserve rediscount rate should be generally above the open market rate:

> It is sometimes argued that the rediscount rate ought to be a *maximum*, and that, when the market rate is above it, that is a sign that the rediscount rate is not effective. The argument proceeds from a fallacious comparison with the London market. The London counterpart of the ordinary "commercial paper" of New York, the one name promissory note, is not the bill of exchange, but the bank advance. Bank advances, not being embodied in any negotiable document, cannot be discounted at all, and they are usually made at a fixed rate of, say, 1 per cent, above bank rate. Bills are discounted at a low rate because they are readily salable in the market, and are almost the equivalent of cash. The bank rate, though usually above the market rate of discount, is below the prevailing rate of interest on advances. In London rediscounts are only an occasional phenomena, and are usually small in amount.

The author here calls attention to the fact frequently overlooked in this country that the London open market rate and the Bank of England rate both apply to bank acceptances, while usually in this country the market and federal reserve rates pertain to commercial paper, which naturally bears a higher rate than bank acceptances, the difference being approximately the amount of the commission charged by banks for accepting bills.

The writer is a fairly strict adherent of the quantity theory of money, and in accordance with this theory his proposals for remedying the prevailing monetary ills are largely based on a very rigid regulation of the supply of credit by the central banks. He looks upon the central bank discount rate as a very effective instrument for preventing inflation under practically any circumstances if courageously applied. Indeed he attributes not a little of the inflation evil in England during the war to the Bank of England's failure to check the expanding absorption of bank credit by the country's industry and trade through the maintenance of a sufficiently high discount rate. It is rather remarkable that throughout all his discussion he pays very slight attention to such fundamental factors as the war's destruction of capital and manhood, and its disorganization of the economic and financial fabric of the world, as causes of inflation. British inflation, he contends, referring particularly to the war period, was due to the increased supply of credit, which addition to the circulating medium might have been avoided if the Bank of England had maintained a higher discount rate throughout the war.

All this, in the reviewer's opinion, mistakes the symptom for the cause, which in a word was the havoc raised by the war. Powerful as the Bank of England is in normal periods, it was, comparatively speaking, a very

* Author of "International Exchange—Normal and Abnormal."

pany institution during the world conflict. To believe that by manipulating its rate it could have forestalled inflation in the face of the tremendous forces making for it that were let loose by the war is indeed to believe in the powers of necromancy.

However, even admitting that a rigid control of credit by central banks is the panacea for all manner of inflation, the question still remains whether it is wise to place in the hands of a few individuals such an enormous power over the material well-being of a nation. We should then have an economic oligarchy of the very first order; or it might be looked upon as a very radical socialistic expedient. However, all this is probably of little more than academic interest, for it is very doubtful if a nation with any form of popular government will ever permit anything of the sort. For evidence of this we have only to turn to events in our own country during the past year or two, and consider how savagely the Federal Reserve Board has been attacked by powerful agricultural and other interests for the part, a comparatively minor one, that it played in the deflation of 1920-1921. The Board has already been shorn of some of its power, through loss of prestige, as the result of this attempt at credit regulation. A democracy will muddle through finance as it does through politics.

THE ENGINEERING INDEX 1922

Compiled and published by The American Society of Mechanical Engineers. Cloth, 675 pp.

REVIEWED BY GEORGE E. HAGEMANN*

THE material of this twenty-first volume of the Index, the fourth issued by the American Society of Mechanical Engineers, comprises articles selected from more than 600 periodicals, reports, and other publications received regularly during the year by the Engineering Societies Library of New York. About 20 per cent of these publications come from Great Britain and her possessions, while 30 per cent are representative publications of France, Belgium, Italy, Spain, Germany, and the South American countries.

Obviously, exceptional care has been exercised in the selection, preparation, and arrangement of the items constituting the Index. Although the average length of the paragraphs characterizing the various articles is noticeably shorter than in the 1921 edition, there are nearly 100 more pages of matter, which means that a far larger number of items has been presented. Furthermore, this volume covers not only the 1922 periodicals received during the calendar year, but also 1921 publications which came in too late to be reviewed in the 1921 index, and a number of late 1922 publications received before February 15, 1923.

The classification and the system of cross-indexing have been improved, and the bibliographical references are given in complete detail. Mechanically the Index continues to be satisfactory, and there is every reason to believe that it will receive from members of the engineering profession the sincerest of all compliments—that of frequent and continued use.

*Associate Editor, MANAGEMENT AND ADMINISTRATION.

FUNDAMENTAL PRINCIPLES OF PURCHASING

By W. D. Murphy. [illegible]

REVIEWED BY [illegible]*

THIS volume differs from most books on purchasing in that it treats the subject in a very general way, leaving to others the discussion of the details. It therefore does not make difficult reading. Being of a size that can be conveniently carried in the pocket, it permits of use at spare intervals.

The topics are well chosen and ably presented. In stressing the need for accuracy and clearness of detail in the composition of requisitions and purchase orders Mr. Murphy exhibits the viewpoint of the experienced purchasing agent who realizes that many difficulties can arise from the misinterpretation of purchase orders lacking in essential details and ambiguously worded. He also does well to write a word of caution in the use of abbreviations.

One point of criticism concerns the arrangement of the chapters. For a book dedicated to the young man contemplating a career in purchasing, the opening chapters are such as to deter rather than encourage further reading of the remaining chapters. It would be unfortunate were the sequence of the chapters thus to detract from the book taken as a whole, particularly in a field which until recent years had little literature of its own. A young man reading it, therefore, will be repaid for continuing the book to the end.

In the opening chapters is outlined a course of preparation in which to acquire knowledge deemed necessary prior to engaging in the purchasing field. "This pursuit of knowledge," the author states, "should cover an indefinite period, perhaps years, until you feel confident that, were the purchasing assigned to you, requisitions would not read like Greek, and your signature on an order would mean something more than just signing on the dotted line." And further on he makes this statement:

> Equipped with the knowledge gleaned from a course of preparation such as has been outlined, to be supplemented by continued study not necessarily so intensive, you may enter into purchasing and command the recognition as a member of a most interesting profession and one which is still new enough to offer unlimited possibilities.

All of this is of interest, but it must also be remembered that practical knowledge of materials, processes, and men, acquired in the field, will not fully qualify a young man to be a purchasing agent. Something else is needed and that "something" is acquired in the atmosphere of a purchasing department. Here is developed the habit of accuracy and clearness of expression, the ability to analyze materials and men and to anticipate requirements, if necessary, because of the experience gained through successive handling of requisitions and constant contact with the market, through salesmen and trade papers. In such environment he gradually acquires the technique of purchasing, embodying certain definite knowledge relative to the pro

*Purchasing Agent, Consolidated Gas [illegible], New York.

fession, and the requirements and policy of his firm, and thus equipped he qualifies as a purchasing agent.

While, therefore, this book may not tell the prospective purchasing agent all that he needs to know, there are outlined in it, in clear, concise language, certain well-defined principles with which he should be familiar. A study of these will be of real value and should constitute an essential part of his training. As the author says:

> The man who formulates and directs the purchasing policies for the whole organization will be chosen for his grasp of fundamentals and not for his ability to purchase any one thing well.

All that Mr. Murphy has written will commend itself to the progressive purchasing agent interested in the advancement of his profession to a still higher level.

A MAN FROM MAINE

By Edward W. Bok

278 pp. Charles Scribner's Sons

REVIEWED BY ARCHER WALL DOUGLAS*

BECAUSE biographies are generally mere panegyries, I have never taken kindly to them. This book was therefore read more or less "on suspicion," but in the end the reviewer was not sorry that he attempted the task.

The purpose of the volume is to demonstrate that business is a romance of the deepest dye, which no one now denies save soviets and syndicalists. In this connection much depends upon the definition of romance. Men have lived and wrecked railroads, and been honored of their fellow men who were in the same boat with them. But they knew not romance—only rapine. Others there were who enlarged the bounds of human thought and aspiration in daily toil, making business an avocation and an education, and they had their reward. So in the first chapter we get a hint of what is coming, just as we do in the advance pictures of the movie which is to be shown next week.

The hero of this romance is a little boy, and rather an unusual one, as it appears that he liked to get up early and work all the time. Perhaps that is accounted for by his New England environment, which is responsible for many non-understandable things, such as codfish balls for Sunday morning breakfasts. This little boy evidently had resolution and grit, for he got into business on his own account, and got away with it because of natural talent and the power to deny himself in the present that he might profit in the future. Few men with this gift can be denied success, and few get anywhere who lack it.

That the little boy, Cyrus H. K. Curtis, prospered, was due not to good luck, for he was not fortune's favorite. It was due rather to his own ingenuity and indomitable perseverance, for he was no quitter. Twice in his early life his savings and his printing plant were destroyed by fire. Yet he kept the faith, as is instanced by the way he rose from the ashes. He had an intuitive sense of just what to do in emergencies, something I have never failed to find in men of pronounced and enduring success. Modern psychologists say that this intuition is the unconscious prompting of long experience. This, however, does not explain it in young men, and Mr Curtis was a young man at the time of his serious misfortunes.

All these happenings are duly chronicled by the author with much particularity, and never without an accompanying moral. Mr Bok borrows Fielding's trick of interspersing his thrills with chapters that have nothing to do with the case. One such chapter is entitled "Is There Dishonesty in Business?" Of course, the author proves that there is not, which is in entire accord with the philosophy of life set forth in *The Ladies' Home Journal*. The only trouble with these stray chapters is that there are no red lights in the channel of discourse to warn you that you are approaching them and should steer clear of danger. One of the tenderest of these excursions is the story of how the man of business should take home the romance of his calling and unload it on his faithful and unsuspecting wife. These discursive essays strengthen the suspicion I have always had that the best bet of the editor is to mess up and mangle the productions of others rather than to exemplify himself the way the thing should be done.

Matters improve as we go along and begin to see the real man about whom the story is told. His thrift and industry, his remarkable power of grasping opportunity, his unusually good judgment and his gift of quick decision all come into play when he finally settles in Philadelphia and enters into his own. His is a purely constructive mind, one that thinks in a straight line and without hesitation. Some men acquire these qualities, but slowly and painfully. With Mr. Curtis they seem innate.

His experience began with his childhood and was associated with hand presses, with the saving of pennies to furnish capital for his tiny newspaper. Now there was opportunity to show what could be accomplished with all this stored knowledge. The remarkable thing was that he succeeded in forcing the breath of life into the dry bones of three publications that had in themselves no promise of success in the future. *The Saturday Evening Post*, in particular, was practically forgotten, not to say moribund. The task required much courage and resolution, and likewise the clearest vision, a power which Mr Curtis enjoys in a rare degree.

It is in such matters that we get the real measure of the man and of his methods. We discern his dislike of detail, which is usually characteristic of those who have real executive talent; his quickness of judgment that rarely went wrong; his courage in financial difficulties; his unfailing sense of what is right and his closely related habit of standing by his guns whenever a principle is involved. Toward the end of the book we get especially those personal touches that are really the only excuse for writing a biography. For after all, it is not so much what a man did, as what he is, that makes his life worth reading about.

* Chairman of the Committee on Statistics and Standards, Chamber of Commerce of the United States.

INVESTED CAPITAL ACCOUNTING

By James W. Beers. 295 pp.
Accountants' Publishing Company

REVIEWED BY GEORGE H. IELLY*

IN view of the widespread belief that going into the service of the government is practically premature burial, it is perhaps only fair to devote the first paragraph of this review to the personality of the author. Mr. James W. Beers, B.C.S., is Special Lecturer on Invested Capital Accounting and Chief of the Training Section, Staff Division, Income Tax Unit, Bureau of Internal Revenue. If the reader wishes still further details, Mr. Beers is a member of the National Association of Cost Accountants and author of "Stock of No Par Value—Its Economic and Accounting Aspects."

The present volume was written with the avowed object of easing the work of the long-suffering men who are required to audit the country's income tax returns. But it has significance for every American accountant who is concerned with income tax work, and that means all holders of the C.P.A. degree who have not retired because of too much wealth or too little health.

"Between You and Me" is the novel caption to a preface which gave the reviewer a distinct thrill, for it appears to be the first preface ever written in which the author of a book personally promises that dissatisfied purchasers may return their copies and receive their money back. In other respects this book is unusual, for it is received by subscribers at the actual cost of manufacture, the authorship rights are waived, and not a penny of profit accrued to anyone interested in the production of the volume.

In spite of these extraordinary features, the fact remains that here is a craftsmanlike piece of work in a difficult field of accounting. Mr. Beers has organized his material well, digested it thoroughly and presented it in admirable form. Especially enlightening are Chapter IX on "Tangibles and Intangibles," and Chapter X on "Admissibles and Inadmissibles." The eleventh chapter covers depreciation, obsolescence, and appreciation, with many concrete illustrations. Chapters XII to XVI, inclusive, are made up largely of "cases," problems and their solutions. This is a very valuable reference book for all whose relation to income tax work is incidental, and a desk book for those who make activity in that field a specialty.

PROSPERITY—HOW TO ATTRACT IT

By Orison Swett Marden. 325 pp.
Success Magazine Corporation

REVIEWED BY FRANK A. FALL†

IN the latest edition of "Who's Who in America" the list of Dr. Marden's published books fills a space of practically three inches in 8-point Linotype, set solid. It is therefore not to be wondered at that the publication of another volume affects only in a slight degree the pulse and respiration of the hardened book reviewer. Doubtless it is very difficult to be original when one is starting on his fourth inch of titles. And obviously it is impossible to avoid constant repetition of such phrases as "When Gordon H. Selfridge went to London," "When Lillian Nordica was a poor girl," "When young Henry Clay was practicing oratory," and "When I was graduated from a New Hampshire academy." Dr. Marden believes implicitly in the whereness of the when, for the reviewer discovered 23 paragraphs beginning with that useful word.

Nevertheless, there are certain truths that will bear frequent repetition, and Dr. Marden presents many of them in this neatly printed and bound volume. The emphasis throughout is upon the idea of thrift, and it cannot be denied that prosperity, whether for the obscure man or woman or for the world-encircling corporation, is in the last analysis a matter of thrift. The same impulse compels the schoolboy to put pennies in his bank and the Standard Oil Company to investigate its own operations to cut costs and increase efficiency.

In the matter of thrift, as in many others, "well begun is half done." Dr. Marden tells how he once sent an interviewer to Marshall Field to ask him, among other things, what he considered the turning-point in his career. His answer was: "Saving the first five thousand dollars I ever had, when I might just as well have spent the modest salary I made. Possession of that sum, once I had it, gave me the ability to meet opportunities. That I consider the turning-point." The author also quotes John Jacob Astor, founder of the Astor fortune, as saying that if it had not been for the saving of his first thousand he might have died in the almshouse.

This volume is not strong meat for the business executive who has earned his way to a place of real responsibility but it should be remembered that for every one of these there are literally thousands who are just starting in at the bottom of the business ladder. For such, the many anecdotes and illustrations recorded by Dr. Marden may well prove inspirational in the truest sense of that much abused word.

PERSONAL SHORTHAND

By Godfrey Dewey. 199 pp.
World Book Company

REVIEWED BY MYRTLE L. ROGERS*

COMPETITION with the professional systems of stenography, which has been developing rapidly during the past five years, appears to have come to a head in this text by Godfrey Dewey of Harvard. Accompanying the text are an exercise book, resembling the ordinary stenographer's notebook in form, and a reader which presents Irving's "Rip Van Winkle" written in Personal Shorthand with a phonetic print key by the author.

This new system of shorthand, referred to for convenience as "P. S.," is based upon the results of years of study and scientific analysis of phonetics and shorthand construction. Incredible as it may appear, it is

* Of Cavanagh and Illa, Certified Public Accountants, New York.

† Associate Editor, MANAGEMENT AND ADMINISTRATION.

* Of Younkin and Rogers, Public Stenographers, New York.

asserted that more than a thousand different systems of shorthand have been published for English alone; yet not one has seemed to meet completely the distinctive requirements of general non-professional use.

As Mr. Dewey indicates, shorthand systems have hitherto been devised chiefly for the professional amanuensis. Student, lawyer, preacher, and educator have continued laboriously to make their many notes in longhand, except for the occasional rare individual who has with great pains mastered a complex professional system for simple personal use. There has always been needed a system of personal shorthand serviceable to the many; one that would enable the busy note taker, after a reasonable amount of special study, to write rapidly, accurately, and simply.

One advantage of "P S" notes is that they do not need to be transcribed. They may be easily read, today or next month or ten years hence, by the one who wrote them or by any other "P S" writer. The system seems to be peculiarly adapted to the needs of the junior high school, for a single year of study will provide for the college preparatory student a tool of immediate and permanent value. For the commercial student it will have a high prevocational value. In view of these facts, the publication of this text and its accompanying illustrative material has all the appearance of an educational event of far-reaching possibilities.

ECONOMIC MOTIVES

By Z. C. Dickinson
vii, 304 pp. Harvard University Press

REVIEWED BY HENRY C. LINK*

ECONOMIC illiteracy, we are led to believe, is one of the most dangerous forms of ignorance with which our present civilization has to contend. A knowledge of the *fundamental* principles of economics, those self-evident truths which bear no denial, is urged as necessary to the preservation of society from radical and destructive measures. In the face of this situation we find, strangely enough, that economists themselves are groping for the fundamental principles upon which their economic doctrines are based.

The familiar and daily tools of economic thinking are the terms, supply and demand, capital, labor, marginal desirability, diminishing returns, unearned increment, etc. Evidently economists are rapidly agreeing that these concepts explain little. Their significance rests upon a more fundamental basis which, to put it briefly, is the desire of the individual for certain kinds of goods or satisfactions. What does the individual want? When does he want it? How badly does he want it? And why does he want it? These are the questions for which the economist feels that he must find answers. And this is the situation which has given rise to the so-called psychological interpretation of economics which Dickinson's book, "Economic Motives," undertakes to analyze.

The attempt to interpret economics psychologically begins, according to most writers on the subject, with the writings of Adam Smith. Psychology, as we know it today, hardly existed at that time; and yet Mandeville, a still earlier writer, interpreted economic facts in terms of human motives approximating those described by modern psychologists far more closely than those discussed by Adam Smith and his immediate followers. A book which, like Dickinson's, proposes to give a comprehensive account of the theories of economic motives, can hardly afford to overlook Mandeville's "Fable of the Bees," little known though it is in our day.

Recent writers on the psychological aspects of economics have confined themselves almost entirely to a consideration of human instincts. This will be found true in Edie's "The New Economics," Marot's "The Creative Impulse," Tead's "Instincts in Industry," Veblen's "The Instinct of Workmanship," in the essays of Carleton Parker, and in some of the writings of Taussig and Fisher. These writers accepted the instincts as described by James, by McDougall in his well-known "Social Psychology," and by other psychologists, as forces whose existence and influence were fairly well established. As a matter of fact, the study of human instincts has never gotten beyond the speculative stage. Almost every psychologist has made up his own list of instincts, and these instincts have varied in number from one to forty or more. Today, even the existence of instincts as psychological entities to which definite actions may be attributed, is being questioned by an increasing number of psychologists. Certainly, economists can contribute little toward making their study more scientific by trying to interpret it in terms of instincts when it is not even known what instincts there are or how they work.

Dickinson's three chapters on the subject of instinct are a critical analysis of the theories of instinct rather than an attempt to project ready-made instincts into economic doctrine. He analyzes also the concepts of hedonism, utilitarianism, habit, emotion, value, which have been advanced from time to time as a key to the explanation of economic phenomena. These studies furnish an excellent perspective to the various doctrines which have marked the development of economic speculation.

The reviews of "Economic Motives" which have appeared so far seem to have overlooked its most significant conclusions, possibly because these conclusions are so briefly stated in the preface and on two pages, 205, 206, in the body of the book. According to Dickinson, "the economist will get more enlightenment upon most points of economic psychology from his own behavior-statistics than from anything in the doctrines of psychologists, who have not yet gotten around to the special problems with which the economist is concerned." We must avoid, therefore, both undue expectations of psychological touchstones, and undiscriminating rejection of the hedonist premises of the classical and marginal utility economics.

Dickinson might well have said that we must avoid also undue expectations in regard to the explanatory value of the doctrines of hedonism and marginal utility. What he does say, however, may be a sufficient warning to those modern economists who, in their haste to formulate their own science, swallow whole the premature conclusions of another science.

*Author of "Education versus Propaganda."

MANAGEMENT DATA

Standardized Methods and Accepted Practice Classified for Permanent Reference

Number 16

INDUSTRIAL STANDARDS IN THE UNITED STATES

Class Number
658(003) Management Standards
62(003) Engineering Standards

STANDARDS for industry may be conveniently grouped into two main classes, dimensional and industrial. The former include definite specifications of sizes, shapes, materials, physical and chemical properties, and the measures to be applied to determine whether the articles affected meet required conditions. Industrial standards are those which regulate operating methods and, as such, concern directly the executive policy of manufacturing.

Dr. P. G. Agnew, secretary of the American Engineering Standards Committee, has listed the following factors as pertinent to standardization:

(*a*) Nomenclature.
(*b*) Purchase specifications.
(*c*) Methods of test.
(*d*) Uniformity in dimensions necessary to secure interchangeability of supplies, and the interworking of apparatus and of parts.
(*e*) Provisions for safety.
(*f*) Concentration upon the optimum number of types, sizes, and grades of manufactured products.

Of this grouping, factors *a*, *c* and *e*, involving nomenclature, methods of test and provisions for safety, are operating or industrial in nature and the rest are dimensional.

The complete grouping applied in the analysis of industrial or operating standards upon which the present compilation was made is as follows:

1. Classification of appliances and materials.
2. Storage of appliances and materials.
3. Specifications, aside from purely dimensional standards.
4. Building codes, from the use and operating standpoint.
5. Test codes.
6. Installation codes.
7. Sanitary codes.
8. Operating codes for machinery, appliances, etc.
9. Safety standards.
10. Fire protection regulations.
11. Installation and operation of anything involved in production either directly or indirectly.
12. Standards of procedure methods in industry, either in direct or indirect relation to production, or in the matter of records.
13. Standards in employee relations.

In treating of each standard there is given, wherever possible:

1. Its name.
2. By whom sponsored.
3. Additional associations concurring in its adoption.
4. Its date of original issue and dates of revision.
5. A brief indication of its provisions and the items it covers.

Unless otherwise indicated, copies of the standards may be obtained either free or at nominal prices from the organizations sponsoring them, except that many government publications are obtainable only through the Superintendent of Documents, Government Printing Office, Washington, D. C.

No study has ever been made by any organization of the extent to which its standards are in actual use, and the collection of such data would be a long and laborious task of tremendous scope. The information here presented has been secured by conference with 40 of the leading national technical, trade, and engineering associations, and several of the government departments. Standards pamphlets were furnished by many of the associations for direct investigation and in addition the comprehensive files of the American Engineering Standards Committee, containing several thousand such booklets, were searched and studied.

In each case a standard is included under the heading of the industry to which it applies, or, if of general use, such as a safety standard, is listed under a special classification covering that subject. Tentative standards, reports proposing actual standards, and similar items are properly labeled to distinguish them from those which have been actually and finally adopted.

ARMY

Instructions Relative to Type, Specifications, and Standardization of Specifications for Articles Used by the United States Army.
  Adjutant-General of the Army. Jan. 5, 1922.
    Special instructions for:
      1. Determining types of articles.
      2. Research and development work connected with (1).
      3. Preparation and standardization of specifications for articles decided upon, standard forms for specifications and drawings.

BOILERS

Boiler Code
  American Society of Mechanical Engineers. 1918 Edition.
    Specifications for construction, operation, maintenance, and testing of new installations, for low-pressure steam and hot-water heating and supply boilers. Operation, etc., of existing installations.
Code for Testing Low-Pressure Heating Boilers.
  American Society of Heating and Ventilating Engineers. Jan. 1918. Rev. 1919.
    Apparatus and instruments, etc., and rules for evaporation tests of heating boilers. Report forms for tests.
Terms of Warranty.
  American Boiler Manufacturers' Association. (No date.)
    Proposals of Commercial Committee for contract forms and regulations for purchasing boilers, also for settings for return tubular boilers.

BUILDINGS—CONSTRUCTION

Regulations Governing Standard Mill Construction, also the Installation of Scuppers.
    Regulation of National Board of Fire Underwriters.
    Recommended by National Fire Protection Association. 1918.
      Definitions, sizes and construction of buildings, floors, roofs, stairs, columns, partitions, equipment, heating, power, lighting. Specifications for timber. Exterior and interior scuppers and installation.
Roof Openings, Cornices and Gutters.
  Regulations of National Board of Fire Underwriters.
  Recommended by National Fire Protection Association. 1918.
    Skylights—construction and protection. Ventilators—construction. Door landings, penthouses, or bulkheads. Scuttles. Open air-shafts, cornices and gutters.
Wall and Partition Openings—Protection Against Fire.
  Regulations of National Board of Fire Underwriters.
  Recommended by National Fire Protection Association. 1918.
    Openings between buildings—doors, belts, shafting, etc.
    Openings inside building—floor to floor, corridors, partitions—construction and doors.
    Openings in walls subject to severe, moderate, and light fire exposure.
  Small Dwelling Construction—Recommended Minimum Requirements.
    Building Code Committee, Bureau of Standards, U. S. Department of Commerce. (Elimination of Waste Series.) 1923.
      Dwellings with brick, tile, concrete block, or hollow brick walls. Concrete dwellings. Frame construction.

BUILDINGS—CONSTRUCTION (Continued)

Small Dwelling Construction (Continued).
      Floors, roofs, furring and plaster, chimneys, heating appliances, fire protection, etc.
  Filing System for Architects' Offices.
    American Institute of Architects. (Doc. 172) 1922. Rev. 1923.
    The standards construct on classification for architectural subjects, with subdivisions.

BUILDINGS—EXITS

Tentative Building Exits Code.
  National Fire Protection Association. May 1923.
  Approved by American Engineering Standards Committee.
    Engineering standards—stairs, fire-escapes, ramps, horizontal exits, doors, aisles, corridors, elevators, escalators, slides, building construction.
    Occupancies—schools, department stores (factories to be included in later edition).

BUILDINGS—FIRE PROTECTION

First Aid Fire Apparatus—Installation, Maintenance, and Use.
  Regulations of the National Board of Fire Underwriters.
  Recommended by National Fire Protection Association. 1922.
    Classification of apparatus. Regulations governing standard pails, foam extinguishers, pump tank extinguishers, chemical extinguishers, sand pails, hand hose, dry powder tubes, hand grenades.
Protection Against Lightning. (Suggestion.)
  National Board of Fire Underwriters.
  Recommended by National Fire Protection Association. 1916.
    Description and instructions for installation of lightning rod equipment, grounding, typical installations covering houses, etc., tanks and stacks.
Sprinkler Equipment—Installation of Automatic and Open Types.
  Regulations of National Board of Fire Underwriters.
  Recommended by National Fire Protection Association. 1920. Rev. 1922.
  Location, spacing, pipe sizes, mains and fittings, alarm systems, water supplies and connections, underground piping, rules for installation and operation.
Hose Houses for Mill Yards—Construction and Equipment.
  Rules and Regulations, National Board of Fire Underwriters.
  Recommended by National Fire Protection Association. 1905.
  Also endorsed by Associated Factories Mutual Fire Insurance Cos.
    Construction, hardware, painting, equipment, racks for hose drying, specifications for play pipe.

BUILDINGS—HEATING

(See entry under Disposal System.)

BUILDINGS—LIGHTING

Code of Lighting. For Factories, Mills, and Other Work Places.
  Illuminating Engineering Society.
  Approved by American Engineering Standards Committee. 1922.
    Rules of illumination, foot-candles for good practice, natural lighting, maintenance of illumination, avoidance of glare, classification of light sources from the glare standpoint, exit and emergency lighting.

BUILDINGS—LIGHTING (*Continued*)

Code of Lighting School Buildings.
Illuminating Engineering Society. April 1918. Report. Jan. 1922.
Artificial illumination intensity, shading and distribution of lamps, finish of interior, switches, emergency lighting, inspection and maintenance. Daylight. Design for artificial light. Refitting old buildings.

BUILDINGS—PIPING

Piping and Fittings for City Gas—Installation, Maintenance and Use.
Regulations of National Board of Fire Underwriters.
Recommended by National Fire Protection Association. 1920.
Definitions, general requirements, precautions, quality and inspection of materials, pipe sizes, pipe hazards, fittings, coverings, maintenance, inspection, pipe to gas engines.

Plumbing Code for Small Dwellings. (In process.)
Bureau of Standards, U. S. Department of Commerce.

BUILDINGS—WATERPROOFING

Testing Felted or Woven Fabrics Saturated with Bituminous Substances for Use in Waterproofing. (Tentative Methods.)
American Society for Testing Materials. (D 146-22 T) 1922.

Testing Bituminous Mastics, Grouts and Like Mixtures. (Tentative Methods.)
American Society for Testing Materials. (D 147-22 T) 1922.

Sampling Bituminous Materials Shipped in Barrels or Drums. (Tentative Methods.)
American Society for Testing Materials. (D 148-22 T) 1922.

CEMENT, LIME, GYPSUM, AND CLAY PRODUCTS

Standard Specifications and Tests for Portland Cement. (C 9-21.)
American Society for Testing Materials. (C 9—21) 1904. Final rev. 1921.
Approved by American Engineering Standards Committee.
U. S. Department of Commerce.
American Society of Civil Engineers.
Specifications for chemical and physical properties, inspection, rejection. Tests—sampling, analysis, properties, mixing, time of setting, tension tests.
Note: Also published by Department of Commerce in a Spanish-English edition, 1918.

Concrete and Reinforced Concrete. (Final Adopted Report.)
Joint Committee—
American Society for Testing Materials.
American Society of Civil Engineers.
American Railway Engineering Association.
Portland Cement Association.
American Concrete Institute. July 1916.
Mixing and placing of concrete (in particular). Adaptability, materials, forms, construction, stresses, etc.

Fire Tests of Materials and Construction—Standard Specifications.
American Society for Testing Materials. (C 19-18) 1918.
Approved (Tentative) by American Engineering Standards Committee.

The following standard methods have also been adopted by The American Society for Testing Materials:

CEMENT, LIME, GYPSUM, AND CLAY PRODUCTS (*Continued*)

Tests for Refractory Materials under Load at High Temperature. (C 16-20) 1920.
Tests for Porosity and Permanent Volume Changes in Refractory Materials. (C 20-20) 1920.
Tests for Softening Point of Fire Clay Brick. (C 24-20) 1920.
Ultimate Chemical Analysis of Refractory Materials, Including Chrome Ores and Chrome Brick. (C 18-21) 1921.
Tests for Unit Weight of Aggregate for Concrete. (C 29-21) 1921.
Tests for Voids in Fine Aggregate for Concrete. (C 30-22) 1922.
Making and Storing Specimens of Concrete in the Field. (C 31-21) 1921.
Tests for Inorganic Impurities in Sands for Concrete. (C 40-22) 1922.
Tests for Sieve Analysis of Aggregates for Concrete. (C 41-22) 1922.
Standard Definitions of Terms Relating to Sewer Pipe. (C 8-15) 1915.
Standard Definitions for Clay Refractories. (C 27-20) 1920.
Recommended Practice for Laying Sewer Pipe. (C 12-19) 1919.
Specifications and Tests for Compressive Strength of Portland Cement Mortars. (Tentative.) (C 9-16 T) 1916.
Chemical Analysis of Limestone, Quicklime, and Hydrated Lime. (Tentative.) (C 25-22 T) 1922.
Sampling, Inspection, Packing and Marking of Quicklime and Lime Products. (Tentative.) (C 50-22 T) 1922.
Tests for Slagging Action of Refractory Materials. (Tentative.) (C 17-19 T) 1919.
Test for Resistance of Fire-Clay Bricks to Spalling Action. (Tentative.) (C 38-21 T) 1921.
Making Compression Tests of Concrete. (Tentative.) (C 39-21 T) 1921.
Securing Specimens of Hardened Concrete from the Structure. (Tentative.) (C 42-21 T) 1921.
Testing Gypsum and Gypsum Products. (Tentative.) (C 26-21 T) 1921.
Definitions of Terms Relating to Lime. (Tentative.) (C 51-22 T) 1922.
Definitions of Terms Relating to Hollow Tile. (Tentative.) (C 43-21 T) 1921.
Definitions of Terms Relating to the Gypsum Industry. (Tentative.) (C 11-22 T) 1922.
Rules for Inspection of Concrete and Reinforced Concrete Work. (Tentative.) (C 44-22 T) 1922.

COAL AND COKE

Sampling Coal—Standard Methods. (D 21-16) 1916.
Laboratory Sampling and Analysis of Coal. (D 22-21) 1921.
Laboratory Sampling and Analysis of Coke. (D 37-21) 1921.
Tests for Fusibility of Coal Ash. (Tentative.) (D 22-22 T) 1922.
Shatter Test for Coke. (Tentative.) (D 141-22 T) 1922.
Definitions of Terms Relating to Coke. (Tentative.) (D 121-21 T) 1921.
Definitions of Terms Relating to Coal. (Tentative.) (D 142-22 T) 1922.

American Society for Testing Materials has adopted all of the above.

CRANES

Code of Safety Standards for Cranes.

American Society of Mechanical Engineers. No. 1572. 1916.

(Report of Committee on Protection of Industrial Workers.)

General Construction of electric traveling cranes, rules for operation, for floormen, and for repairmen.

DISPOSAL SYSTEMS

Blower System Installations for Heating and Ventilating and for Stock and Refuse Conveying. (Also under Buildings—Heating.)

Regulation of National Board of Fire Underwriters.

Recommended by National Fire Protection Association. 1915.

Construction of heating and ventilating systems. Construction and operation of systems for removing refuse, dust, shavings, etc.

ELECTRIC MOTORS

Installation and Operation of Induction Motors.

Western Association of Electrical Inspectors.

(Report of Committee adopted for one year's trial.) 1921.

Size and inspection of conductors, overload protection, motor switches and auto starters, high potential motors, size of mains, enclosures.

Report of Electrical Apparatus Committee.

National Electric Light Association.

Pamphlet T6-20, Technical and Hydro-Electric Section. May 1920.

In particular, pages 32-33, uniform rules to govern the installation and use of motors on central station distribution systems, single phase, 60 cycle, polyphase, 60 cycle, and shunt wound direct-current motors.

ELECTRIC WIRING

Regulations for Electric Wiring and Apparatus. "National Electric Code."

Regulations of National Board of Fire Underwriters.

Recommended by National Fire Protection Association. 1920.

Approved by American Engineering Standards Committee.

Generators, motors, switchboards, etc., outside and inside work for all systems and voltages, constant-current and constant-potential systems, low, high and extra-high potential systems. Fittings, materials, and details of construction, marine work.

ELECTRICAL APPARATUS—BATTERIES, DRY CELLS, ETC.

Electrical Characteristics and Testing of Dry Cells.

Bureau of Standards, U. S. Department of Commerce. Circular No. 79, 2nd ed. Jan. 1923.

Theory and construction of the dry cell, sizes, and kinds, electrical characteristics, testing, and specifications.

ELECTRICAL APPARATUS—GENERAL

List of Inspected Electrical Appliances. (With supplement.)

Underwriters Laboratories of the National Board of Fire Underwriters. April 1922. Suppl. Oct. 1922.

Inspected and approved types of electrical devices meeting the requirements of the underwriters.

List of Inspected Electrical Appliances.

Associated Factory Mutual Fire Insurance Companies. 1922.

Inspected and approved types of electrical devices meeting the requirements of the association.

ELECTRICAL CONTROL [illegible]

Safety Rules for [illegible] Control Equipment [illegible] by [illegible]

Electrical Safety Conference composed of

Associated Manufacturers of Electrical Supplies.

Bureau of Standards, U. S. Department of Commerce.

Electric Power Club.

National Workmen's Compensation Service Bureau.

Underwriters Laboratories. 1920.

Scope of work, definitions, classes of apparatus, classes of persons, hazards, method of protection, construction, installation, rules—low and high voltage, rules for controllers, safety enclosures.

Control Apparatus (Transformer Type).

Underwriters' Laboratories, National Board of Fire Underwriters. 1920.

Specifications for supervision, construction, and test.

Control Apparatus (Resistance Type).

Underwriters Laboratories, National Board of Fire Underwriters. Feb. 1920.

Specifications for supervision, construction, and test.

ELECTRICAL INSULATION

Specifications for High-Grade Rubber Insulation, and a procedure for the Chemical Analysis of Rubber Compounds.

American Institute of Electrical Engineers.

(Joint Rubber Insulation Committee Report.) Apr. 1917.

Procedure, sampling, apparatus, preparation of reagents, operations, statement of results.

ELECTRICAL MEASUREMENTS

Electrical Units and Standards.

Bureau of Standards, U. S. Department of Commerce. Circular No. 60, Mar. 1920.

System of units, units and standards of principal electric quantities, magnetic units, symbols.

ELECTRICAL METERS

Code for Electricity Meters.

Prepared by the Electrical Testing Laboratories, under instructions of Joint Meter Committee of Association of Edison Illuminating Companies and National Electric Light Association. June 1913.

Definitions, standards, and measuring instruments, specifications for acceptance of meters and auxiliary apparatus, installation and test methods, maintenance methods.

ELEVATORS, DUMBWAITERS, ESCALATORS

A Code of Safety Standards for the Construction, Operation and Maintenance of Elevators, Dumbwaiters, and Escalators.

Prepared by American Society of Mechanical Engineers. Jan. 1921.

Associates—Bureau of Standards, U. S. Department of Commerce.

Elevator Manufacturers Association of the United States.

Elevator Manufacturers Association of New York.

Casualty and fire insurance companies.

American Institute of Architects.

Engineering societies, individual engineers, individual elevator manufacturers, etc.

Complete set of operating rules for passenger and freight elevators and dumbwaiters, power and hand lifts, escalators. Inspection and maintenance of various classes of elevators. Qualifications and duties of operators.

(To be continued)

MANAGEMENT AND ADMINISTRATION

FOR OFFICERS EXECUTIVES AND DIRECTORS OF INDUSTRY

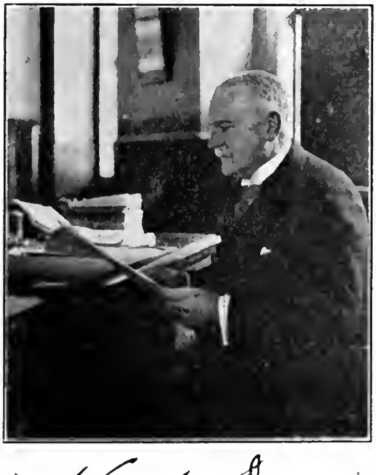
VOLUME VI — AUGUST 1923 — NUMBER 2

Insuring the Executive Asset

By W. A. DAY

President, Equitable Life Assurance Society of the United States

NEWSPAPER headlines, during the past few years, have frequently drawn the attention of the public to the tremendous money value placed by business organizations upon the brains or ability of certain individuals, as evidenced by the amount of life insurance which they carry on these human assets. A recent article in a New York daily,[1] under the striking caption, "Sixty Americans Insured for One Million or More," reported the names of outstanding figures in the motion-picture world on whom insurance running into several millions is carried, and a number of key men among firms of manufacturers, bankers, and merchants insured for amounts above the million mark. These more or less spectacular instances serve to keep what is termed "business insurance" before the public eye. But, as a matter of fact, the business world, generally, is only beginning to realize the importance of this form of insurance coverage.



W. A. Day

Business insurance is simply a special application of the general principle of "indemnity against loss" which is embodied in every form of insurance. It is considered as a special branch of life insurance merely because of its rapid growth as a recognized economic factor in modern business conservation. But just as the primary function of life insurance is to provide indemnity to a man's family in case death should cut short his earning power, so the chief purpose of business insurance is to indemnify a business organization against the loss of the earning power of an important member, be that earning power represented by character, technical knowledge, general business ability, or resources of a financial nature.

First Business Insurance Policy in America

The statement that the general recognition of the importance of business insurance is fairly recent by no means implies that the use of business insurance is a recent idea. The use of business insurance in this country dates back at least as far as the days following the Revolution when, by this means, the impoverished state of Virginia was enabled to employ the greatest living sculptor to make an image of George Washington.

Jean Antoine Houdon, one of the great sculptors of all times, had agreed to make a statue of Washington on the condition that if his life should be lost during the perilous journey from France, his family should receive 10,000 livres or about 400 guineas. An accident would, therefore, have been a financial tragedy to Virginia for, in addition to the sum which was to be paid to Houdon's family, Houdon's traveling expenses had to be paid and a large outlay was required for marble.

Through the negotiations of Thomas Jefferson and

[1] *The New York Times*, April 29, 1923.

John Adams, insurance was eventually procured on the life of Houdon to indemnify the state of Virginia for the larger part of the loss she would suffer in case of the sculptor's death.[2]

At the present time business insurance is used in much the same way as a method of guarding against possible loss, when the successful completion of a particular piece of work depends upon the life of an individual. A certain publishing firm, for instance, contracted with Commodore Peary for the account of his experiences on the journey to the North Pole. If his life had been lost, the firm would have been put to considerable useless expense through preparation and advertising—not to mention the loss of profit from the publication. This risk was covered by a good-sized policy.

In a large number of cases the sudden withdrawal through death of the ability, knowledge, or capital contributed to a business organization by an individual would be a greater catastrophe than the burning of the plant or the loss of stock. Yet the carrying of insurance on stock and buildings has long been recognized as a business necessity, while it is only within recent years that business organizations have realized the amount of risk they assumed in not protecting themselves against the loss of valuable human assets.

For purposes of illustration, take the following advertisement which appeared in one of the daily papers:

> A Government Order for 100,000 pounds of hemp is being filled by a hemp mill. The mill has been running for a week; it is brand new, and the largest and best in America. Its president was suddenly killed last week and leaves debts for machinery, etc. The mill is being managed by a man of six years' hemp-mill experience, and the past shows the industry to be an extremely profitable one. A person with enough capital could carry the mill through and have a wonderful business. Call quickly.

There is little doubt that if a fire had threatened to wreck this plant, the newspaper notice would have included the statement "loss fully covered by insurance." But the average business man would probably have been more or less surprised if the statement "financial loss to business fully covered by life insurance" had appeared in the reports of the accident.

Insuring Business Brains

Too often we think of a business as something separate and distinct from the directing heads. The plant, offices, machinery, are thought of as the business, when, in reality, they are mere tools for carrying on the business and depend on brain power for their effective use. The remark of Andrew Carnegie regarding the value to be placed on "business brains" is familiar to most men of affairs:

> You can take everything—our plants, our mines, our railroads, every physical thing that we possess—but leave us our organization of business brains and in two or three years we will be in full swing again.

Since the loss of the "business brains" through death is a contingency that can be foreseen, and since it is an unwise business policy to assume foreseeable risks, it stands to reason that business insurance meets an actual business need. Obviously, the business insurance may not make it possible immediately to replace brains or ability loss through death any more than fire insurance would make it possible immediately to replace the building that is lost; but equally obvious is the fact that adequate capital would make it possible for the organization to bridge the period of readjustment and, if necessary, to go into the market as a bidder for the brains or particular ability required.

Insurance Coverage as a Stabilizer of Credit

The second function of business insurance, closely tied up with that of indemnifying against loss, is its function as a promoter and stabilizer of credit. From the standpoint of both borrower and lender this function looms high in importance.

Loans are sometimes made by banks to persons whose chief assets are their character and ability. When the completion of the business project depends on this character and ability, the one dangerous contingency is death before the realization of success. The most practical method of preventing a financial catastrophe, due to this cause, therefore, is through life insurance.

Banks are not ordinarily concerned as to the safety of their lines of paper when conditions are prosperous and those to whom they have extended credit are progressing and making money. Adverse conditions, such as an unexpected change in the management, however, may shake their confidence. Notes that otherwise would be extended are called for payment or the line of credit may be reduced. Just when a thousand and one problems are facing the new manager, he must attack the difficult question of securing credit. At this time the payment to the organization of a substantial sum of money may rebuild the structure of confidence.

A few years ago, three young men in a large city in the Middle West organized a firm for the manufacture of jewelry. These men had formerly been employees of well-known jewelry houses—one a chemist, one a sales manager, and the third in a clerical capacity. Their capital was relatively small, but because their integrity and specialized ability were known to the financial world, fairly large amounts of credit were extended to them. The business prospered beyond their expectations, but on account of its rapid growth they found it necessary still further to extend their line of credit. When it was thought advisable to borrow more money, their bank suggested that they secure business insurance, which they arranged for in the amount of \$50,000 on each of their lives. Four years after the insurance was taken out an automobile accident resulted in the death of two of these men—one instantly, and the other in a hospital a few days later. The payment of \$100,000, however, so adjusted the credit situation that the disturbance was minimized and the strong financial position in which the firm found itself enabled it to obtain competent men to fill the gap in the organization. There can be no question that the insurance carried on the members of the firm aided very

[2] A study of the letters and original documents relating to this transaction, made by the author, brought out the facts in regard to what is probably the first business insurance policy procured in America.

materially in the reorganization if, indeed, it did not prevent complete disorganization and failure.

When we realize that a very large per cent of the country's business is done on a credit basis, the value of a factor which tends strongly to stabilize credit becomes apparent. At the present time all the federal reserve banks, with the exception of one, feature life insurance in their financial statement blanks; Bradstreet's Mercantile Agency and the R. G. Dun Agency have both included "life insurance payable to business" as part of their recent statement blanks; the form of the National Association of Credit Men features the "amount of life insurance for benefit of business and with what companies;" and the condensed financial statement adopted by the American Bankers Association refers to "life insurance in favor of the company."

The third function of business insurance is to create a sinking fund, or emergency fund, to provide for some definite object or possible contingency. For example, where the form of business organization makes it possible for an associate's heirs or family to interfere with the management of the business after his death, life insurance furnishes what is probably the most practical plan for creating a sum to buy out that interest. There are numerous ways, of course, to create this sinking fund, but by none of them, except through life insurance, is the entire fund, which would be necessary, created immediately.

Coverage for Corporations, Partnerships, and One-Man Enterprises

The general purposes served by business insurance are more or less the same, no matter what the form of organization; that is, whether the business is a corporation, a partnership, or a one-man enterprise, business insurance on the "business brains" will serve to indemnify the business in case death eliminates this important factor; it serves to stabilize the credit of an organization; and by means of the business insurance policy, a sinking fund may be created. But the particular conditions existing in a corporation, in a partnership, or in a one-man business create particular needs for business insurance.

In the case of the corporation, for instance, business insurance can be used to prevent the stock from becoming "dead wood" if on the death of a member this stock goes to those who are interested only in the dividends received. The insurance provides funds which may enable those actively interested in the progress of the company and capable of managing its affairs to keep the stock in their own hands.

Partnerships, and the same may be said of close corporations, are usually formed among men, each of whom has a particular contribution to make to the organization. To remove one factor is like trying to run a motor without gasoline or some essential part. Some plan of offsetting the possible financial loss, without impairing the working capital, therefore, becomes almost a necessity. If business insurance is carried, the event which creates the loss creates the funds to make good the loss and, if necessary, to liquidate the partner's interest.

In the case of the one-man [illegible] insurance ordinarily serves the same [illegible] sonal insurance. The financial situation [illegible] family may be dependent on the success [illegible] venture which, in turn, is dependent on [illegible] ability of the man at the top. If, in case [illegible] death, the family are able to employ a competent [illegible] to run the business, through the proceeds of [illegible] insurance policy, their income is not cut off. In the one-man business, too, business insurance often serves as an "anchor to windward." Many men can be relatively sure of carrying speculative enterprises through if they live, but do not wish to have their families assume the risk if they should die. A risk of this sort may be eliminated by means of a business insurance policy carried over the period of the uncertainty.

Form of Insurance Adapted to Meet Need

Any estimate of the total cost of business insurance is out of the question as any estimate of the cost of personal insurance is out of the question. Rates per thousand are calculated on the same basis as the rates per thousand on personal insurance but the actual cost in both cases is determined by the uncertain length of human life. Less than five years ago, the three directing heads of a large manufacturing organization procured business insurance amounting to $500,000 on their own lives. Before two years had elapsed, two of the officials had died and not many months after the death of the second official, the third was killed in an accident. The total premiums paid on this $500,000 insurance were $17,000. Cases of this sort are, of course, unusual, but in estimating the yearly cost of business insurance, the fact should be borne in mind that the premiums deposited for life insurance cannot be considered as expense in the ordinary sense of the word. The ledgers should be charged each year with the deposits made, but a credit should be set up for the increase in the cash value of the policies from year to year.

It is likewise impossible to state what form of insurance is best suited for business purposes. Each individual business has its own individual need and the form of insurance procured should be the form best adapted to meet that need.

Companies Now Realize Importance of Business Insurance Idea

Only within recent years have the insurance companies themselves actually realized the importance of business insurance as an economic factor. Consequently, only within recent years have they made an effort to send out representatives thoroughly equipped to handle business problems and to provide means whereby the business man may obtain accurate information regarding business insurance in general and the particular plans of business insurance best suited to carry out his purpose. However, the wider opportunities for insurance salesmen created by the wider use of insurance—insurance for the protection of a business, for the payment of inheritance taxes, and other uses—have, in turn, attracted larger numbers of men with the ability to handle the more intricate problems which these types of insurance involve.

With adequate facilities for rendering a high type of business insurance service in the insurance world, therefore, and with an increased number of insurance representatives equipped through ability and training to handle business problems, there is little doubt that the importance to a business of insurance on the brains, ability, and character of its key men will be generally recognized and business insurance, like other forms of insurance, ranked as a business necessity.

Costly Maintenance Due to Too Much Labor Specialization

By EVERETT W. HOWE

Class Number
658.58 Plant Maintenance

SAVINGS in plant maintenance, effected by extreme specialization in the forces of the plant department, are very often carried too far in practice, resulting in excessive costs. The following article embodies several suggested remedies for this, based on conditions observed at first hand in a large manufacturing plant. It is probable that similar conditions exist in other industries throughout the country.

In the first place, there are many small jobs about a plant, each of which may, under usual conditions, require the services of several trained men. Many of these might easily be taken care of by one good "handy man," such as was found a few years ago in every plant, but has now disappeared except in an occasional small plant. In many cases these small jobs account for large items in the maintenance charges.

To avoid this condition there should be employed by the maintenance department several "handy men," who should have a fair knowledge of all phases of the maintenance work of the plant. To gain this knowledge each of the men should serve for a short time in each of the repair divisions.

After such training, these men could, in case of emergency, be called into any one of the regular maintenance departments, as it is not usually the case that more than one department is rushed at the same time. This alone should cut down the size of the repair force.

Emergency Repairs

But these men would be of even greater value in taking care of many small jobs about the plant. For example, a foreman may find that in his department there is a leak in the piping, a belt that needs to be taken up, an electric light that needs to be repaired. Under the usual system, a steamfitter, a millwright, and an electrician, each with a helper, would be needed. For each job a trip must first be made to determine the true nature of the repair and to see what tools and parts are needed.

If a man were trained to make minor repairs in each of these lines, he and his helper would first make an inspection of all the work to be done and would then go to the stockroom and get whatever tools and parts might be needed. They would then make all the repairs and when their work was finished that particular department would be in first-class condition.

In this way, a great deal of time could be saved which is now used up by men going to and from the stockroom to get tools and parts. This plan would also leave the more highly trained men free for the more difficult jobs.

There is another cause of high maintenance costs. A company may make in its own shops many small replacement parts and new devices which can be bought for less money in the open market. This is especially true of many small parts which are made on a production scale for the open market, but of which only a few are needed in even a large plant. There is also a tendency to repair many small parts by welding, which can be bought new for less money.

Repairing Small Parts

Of course there are times when this practice is to a certain extent justified, as when the company shops have very little to do, and it is desired to keep a certain number of men busy. However, when the plant is operating at or near full capacity the shops are usually rushed on necessary work.

Still another cause of big repair bills in the large factories is this: The operators pay too little attention to minor ailments of their machines, which, if taken in time, would save much time and money in repairs. Every machine operator should understand the construction of his machine, and should have it impressed upon him that he is to call to his foreman's attention any unusual noise in operation or anything which he believes needs to be repaired. Many departmental foremen know very little about the machinery operated by their men. This is even worse than the men themselves not knowing. Each foreman should have such small tools as would be needed for making the simplest repairs. This would still further reduce the number of calls to the repair department.

The tendency to let machinery go as long as it will run at all is especially common in plants where bonus and piece-rate wage systems are in use. The operators want to run their machines as long as possible and fail to realize that most of the big repair jobs grow from small ones. If every machine operator were taught something of the construction of his machine and of the cost both to himself and to the company of letting the small things go unnoticed, many expensive repair jobs would be avoided.

The Organization of Modern Industry

II—Economic and Social Effects of Industrial Revolution

By DEXTER S. KIMBALL

Dean, College of Engineering, Cornell University

THE industrial and social changes brought about by the Industrial Revolution cannot be very well understood unless there is a clear understanding of the principles involved in the four great inventions. These machines themselves were neither complex nor efficient as measured by modern standards. Nor does the statement, so often made, that this change was a transition to *machine industry*, give a true explanation of the matter. Machines had been in use for many years in various callings, and factories and factory systems of manufacture had already appeared. The great inventions were important because they involved an application of what is known as *transfer of skill* greater than had been previously embodied in any other industrial implements. Up to the time of these inventions skill of hand had been the important factor in production and the tool or machine had been an adjunct. But with these new inventions the machine became the important factor and the worker became an adjunct. The use of nearly all tools and implements involves transfer of skill. It was much easier for our savage ancestors to whittle out arrows with bronze knives than with stone knives, and, in general, manual skill is of decreasing importance as tools of production are more highly developed. Or, expressing it another way, man's productive skill is increased as he improves his implements of production.

An Ancient Oriental Lathe

This principle may be made clearer by considering the production of circular forms, so common in industrial work. In Fig. 9 is shown an oriental "lathe" or "turning machine" of ancient origin, and its skilful operator, as exhibited at the Pan American Exposition in Buffalo several years ago. The piece to be turned into circular shape was mounted, as can be seen, on two stationary points. The operator rotated the work to and fro by means of the bow held in his right hand, the string of the bow being wrapped once around the piece to be turned. The turning tool was held in the worker's left hand, resting upon a cross bar, and as the work rotated toward him it was cut into circular form by the sharp tip of the tool. When the hand became tired the workman relieved the strain by guiding the cutting end of the tool with his great toe and the next one to it. (See Fig. 10.) His skill of hand or "skill of toe" was remarkable, and the rapidity of the operation unbelievable.

This ancient tool has come down to us in modified form probably through Spain, by way of the Moors. Fig. 11 shows an occidental form of this implement adapted to western habits where the worker stands rather than *sits* at his work. The work

Fig. 9. An Oriental Bow Lathe

The bow or driving device is held in the right hand and the cutting tool in the left. Note the long centers upon which the work is mounted.

is rotated toward the workman by the foot treadle and returned from him by the spring pole above. The writer remembers seeing one of these old lathes in his boyhood. Obviously, with such tools the turning of circular forms, accurately, was a skilful performance, and even to make a true cylinder of any appreciable length required long training in the art.

First Great Step in "Transfer of Skill"

The first great step in transfer of skill in this form of tool of which we have record is found in the lathes made by Maudslay about 1800 and shown in Figs. 12 and 13. They are made entirely of iron and in Fig. 13 a piece of metal is shown mounted between the "centers" so that it can be rotated in the *same direction always* by means of the hand wheel. But the cutting tool is held firmly in a tool-holder that is carried in guides which slide along upon the finished surfaces of the bed so that the tool can be moved parallel to the axis of the work in a very accurate manner. This tool-holder or saddle, as it is technically called, can also be actuated by a screw (which cannot be seen), but which is driven by the small gears at the hand wheel. If the tool is once properly set a man of mediocre skill can easily turn a cylindrical surface much more accurately than could the old mechanic with his ancient lathe and masterly skill of hand. Another early lathe is shown in Fig. 15.

Maudslay's Improvements Still in Use

All modern standard turning lathes (see Figs. 14 and 16 as examples) embody these improvements found in Maudslay's lathe, and few, if any, others of equal importance. The transfer of skill in this machine is comparable to that made by Hargreaves in his spinning jenny. The greatest degree of skill in hand spinning was required to draw the thread accurately away from the end of the spindle, but in the spinning jenny this skill was rendered unnecessary by the traveling carriage which drew out the threads and which is plainly shown in the illustration of that machine in the preceding article.[1]

The next great advance in transfer of skill in the development of the lathe was the introduction of the turret. It will be clear, that even with a lathe embodying Maudslay's principles a considerable amount of skill is still necessary to *set* and *adjust* the cutting tool; and if several operations are necessary this skill may be considerable; and also much time may be consumed in this work. If, however, a series of tools are arranged in a turret (Fig. 17) so that they can be adjusted once for all and brought into operation by turning the turret into the required position, an operator of very limited skill can operate the machine. When practically all the necessary skill has been so transferred to a machine, but the machine still requires an attendant, it is called a *semiautomatic machine*. The sewing machine is an excellent example of a semiautomatic machine. It requires an operator, but practically *anyone* can sew with such a machine with a minimum of experience.

The Automatic Machine

In using any semiautomatic machine the operator must still do some *thinking*. In the case of the turret lathe he does not have to think about the accurate alignment of the tool, since that is cared for by the mechanism itself, and the tool-maker has already performed that mental labor for all operations. It appears, therefore, that a transfer of *mental skill* or *intelligence* can also be made from a person to a machine. The last and most interesting stage in the development of the lathe was therefore the application of a "brain wheel" which controls automatically the movements of the turret so that no operator is necessary. Such a machine (Fig. 18) belongs to the class of machinery known as "full automatic machines." The modern player-piano

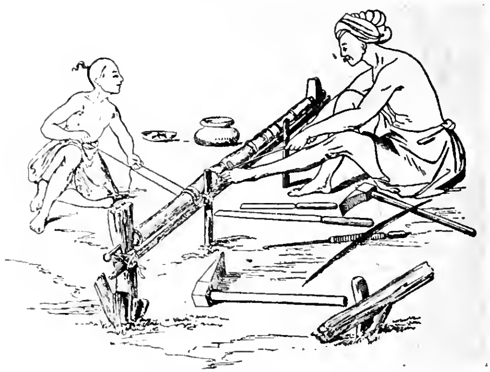


Fig. 10 AN ORIENTAL TURNER AND HELPER
The helper drives the work by means of the wrapped cord or "belt." Note the "skill of toe" of the turner.

is an excellent example of transfer of skill and intelligence or thought. The thought of the composer is transferred quite accurately, but in most player-pianos the transfer of playing skill is more or less imperfect. It should be noted that composing and playing are usually not the accomplishments of the same man, and the composer whose thoughts are transferred to the machine may be long since passed away. The principles of transfer of skill and transfer of intelligence lie at the bottom of modern industrial methods and no two mechanical principles are more used in the construction of modern automatic machinery than Maudslay's slide rest and Stone's turret attachment.[2]

Labor- and Time-Saving Machinery

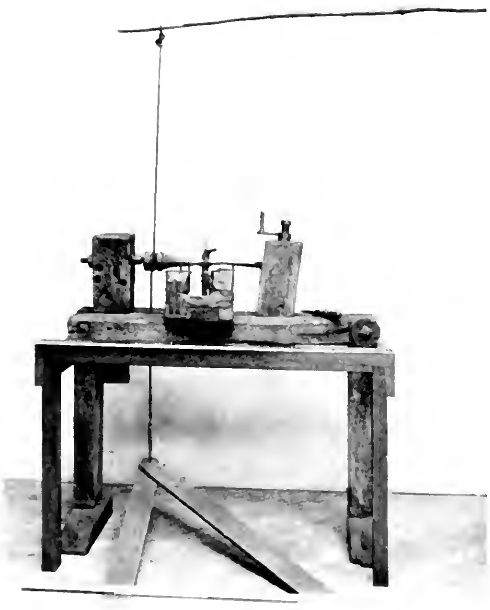
It should be carefully noted, however, that all machines do not involve transfer of skill. The wheelbarrow, for instance, is one of the first great labor-saving devices, but it in no way reduced the amount of skill necessary to dig and delve. It belongs to the class of machines by which man has increased his *physical power*, the culmination of which is found in modern prime movers such as the steam engine and the gas engine. This latter class of machine is accurately described as "labor-saving machinery." Machines involving the principles of transfer of skill and thought, though often of the labor-saving type, are perhaps

[1] MANAGEMENT AND ADMINISTRATION, July 1923, p. 17.

[2] A most interesting series of articles by Henry Roland on the introduction of these principles into modern industry will be found in *The Engineering Magazine* for 1899.

more accurately described as "time-saving" machines. The actual manual work of operating a turret lathe may be much more laborious than that of operating a standard lathe in producing the same product. But with the turret lathe the operator can produce more pieces of the same kind in a given time than he can upon the standard lathe, hence the time for each piece is much less.

Aside from the lower cost of production incident to the use of less skilled men, these modern machines lower the cost of production, because much less time is used in producing a given piece. As will be shown later, the economic use of time-saving machinery depends upon the quantity to be produced; but it will be clear that if this quantity is sufficient to warrant the use of such machines, hand production is hopelessly at a disadvantage, and unless other influences intervene it will surely disappear from competition. It is true, of course, that handicraft production may survive for a time and compete on the basis of *quality*. This was true for a time in the textile industries during the early stages of the industrial revolution. But in time the economic advantage even on this ground appears



In the South Kensington Museum

Fig. 11 An Ancient Pole Lathe

Note the wooden bed, head stock, foot stock, and tool rest, also the driving device treadle, twisted round belt and pole.

to be with the machine. Thus in the making of cylindrical surfaces discussed in the foregoing the modern grinding machine will produce such surfaces so accurately as to be utterly beyond any handicraft work, and it is now an established fact that the machine-made watch greatly excels the old hand-made watches so highly regarded a few years ago. Many lines of hand-made articles, as for instance hand-decorated pottery, will probably always find a ready market, but the demand for such articles rests upon other grounds than lowest cost of production.

The development of modern machine methods has been accompanied by a corresponding development in so-called scientific methods and a resulting increase in our scientific knowledge, such as the world has never before seen, so far as we have record. Any discussion of this field of knowledge is beyond the scope of these articles, but it should be noted that the extension of our knowledge in the basic sciences such as chemistry, physics, mathematics, and biology has greatly stimulated industrial methods which, in turn, have stimulated scientific research to a remarkable degree.

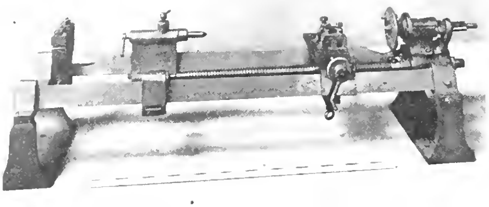
Principal Effects of Industrial Revolution

The principal effects of the Industrial Revolution will now be discussed; but it should be remembered that while great changes have already been brought about, these effects are far from being matters of the past. The introduction of any labor- or time-saving machinery, or of *labor-saving management* which will be discussed later, is almost necessarily accompanied by some or all of these changes in some degree. The first effect was to accent more markedly the separation between agriculture and the mechanic arts that had been started under the old handicraft system. Today this division is quite distinctly marked. No farmer pretends to make his own implements and should he do so he could not compete with the implements made in the modern factories.

The Separation of Workman and Tools

The most significant effect, however, was the separation of the workman from the ownership of the tools of industry. Up to that time he could obtain almost any of the primitive handicraft tools with small exertion. But *capital* was now needed, not only to build these new implements, but also to provide power to operate them. While it is true that under modern methods of mass financing the thrifty worker may acquire a financial interest in industrial enterprises, it is equally true that individual ownership of specific tools of production is a thing of the past in the field of mechanic arts. In agriculture the farmer still owns his own implements though he does not manufacture them. It is undoubtedly true that this dependence of the mechanic arts workers upon capital for an opportunity to earn a living is one of the most deeply rooted causes of industrial discontent. The idea of returning the ownership of the tools of industry to those who use them is the tap-root of most socialistic doctrines. This was, and still is, the predominant thought in the minds of those who led the Russian Revolution, and the difficulties of realizing such an ideal are well illustrated by the conditions of that most unhappy country. The adjustment of these relations presents the most difficult industrial problem that we face today. It is not very surprising after all, that those who have a large share in the creation of products but little or nothing to do with the buying and selling of them, should begin to question old, established ideals such as the sacredness of private property. This basic difficulty must be met and solved if industrial peace is to be assured.

The next important effect of these new methods was the competition instituted with the old hand-workers. These workers found themselves confronted with machines that, operated by children, could produce vastly more and cheaper product than they could with handicraft implements. One of two courses lay open to these handicraftsmen, namely, to seek employment in other lines, or to be *degraded* economically to the level of the machine attendant. Experience shows that it is very difficult for a worker to change his calling, and in these days of organized labor it is almost impossible to do so. The old handicraft textile workers were degraded economically, in many cases their entire handicraft trade ceasing to be an industrial factor, so radical and so swift was the change. Similar results followed in other callings with greater or lesser rapidity. The shoemaking industry, for instance, did not wholly succumb to these changes until comparatively recent years; but today the old handicraft shoemaker is extinct, shoes being a strictly factory-made product.



In the South Kensington Museum

Fig. 12 MAUDSLAY'S SCREW-CUTTING LATHE BUILT ABOUT 1797

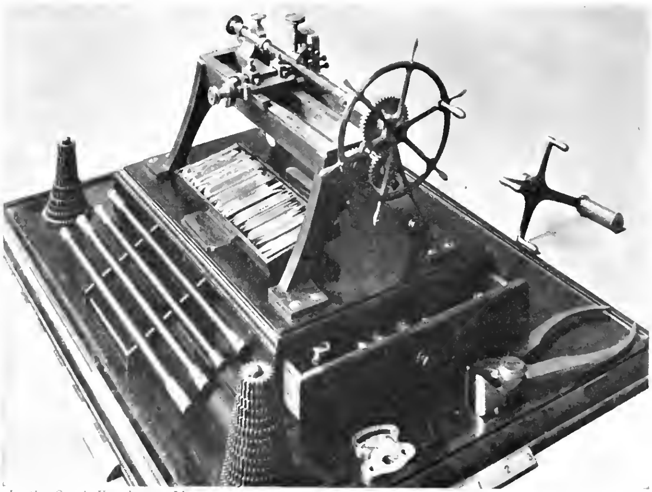
In principle this is the prototype of all modern machine tools combining a tool-carrying block, power feed, and change gears.

This so-called *degradation of labor* is one of the first effects to be felt whenever labor-saving machinery or labor-saving management is introduced. At the time of the Industrial Revolution its influence was very marked, since the textile trades constituted the major portion of industry; and this influence has been less marked as the field of industry has broadened, as new callings have appeared, and as some of the earlier changes have been absolved. But it is an effect that is ever-present wherever modern methods are installed, and it appears that no great advances can be made without working hardships on some class of producers. For this reason, those workers who are most directly affected, instinctively recognizing these dangers, are usually opposed to the introduction of new methods. Hargreaves' neighbors mobbed his house, and burned his machine. But opposition of this kind apparently has never prevented the final adoption of improved methods, if it is clear that the majority of people will benefit by their adoption.

These disturbing tendencies are somewhat compensated for by others which will now be noted. It will be obvious that the use of improved machinery and processes has enabled many semiskilled and unskilled workers to take an important part in many industrial fields formerly filled solely by skilled workers. Thus all small manufactured goods made in large quantities are produced almost wholly on semiautomatic and automatic machinery operated by semiskilled workers. This is true of bicycles, clocks, automobiles, telephones, and innumerable articles of everyday use. In practically all large manufacturing plants, today, the unskilled and semiskilled workers greatly outnumber the skilled, and products of great accuracy and fine finish are so manufactured. This principle, which may be called the *extension of the field of labor* is a very important one for it will be clear that as more skill and intelligence are transferred to hand and machine tools, it becomes increasingly easy for men and women of little skill and mechanical intelligence to participate in mechanical industry.

Economic and Social Elevation of Labor

And it should be particularly noted that because of this extension of the field of labor many new fields of production have been opened up. The telephone, the sewing machine, the phonograph, clocks, watches, and countless other articles now considered necessities of daily life are obtainable by vast numbers of people, who except for these new methods could not have been so favored. The opening up of new fields of produc-



In the South Kensington Museum

Fig. 13 MAUDSLAY'S SCREW-CUTTING LATHE BUILT ABOUT 1800

In many respects this lathe is modern in appearance, having a cast-iron bed, back rest, and 28 change gears. On the rack in front are shown several screws cut on this machine.

tion and the consequent farther extension of the field of labor must be credited largely to these new industrial methods.

Furthermore, the ultimate effects of these new methods may be to *elevate* certain classes of labor. The skilled workers in the metal working trades have, on the whole, been greatly benefited by the enormous demand for modern machinery, though at times these workers have passed through trying periods of adjustment due to new inventions. As will be shown later, this has created a new *tool-making* class of workers who fill a most important place in industry.

The unskilled worker also who has been taken from low-paid manual employment and taught to operate a semiautomatic machine is of greater value to society than formerly, and his remuneration is consequently higher. He and his family are elevated *economically* and consequently e l e v a t e d *socially* also. The industrial history of New England illustrates very clearly how the successive waves of immigration that have moved into that territory have been absorbed, to a large extent, through participation in her great factory life.

Immediate Results of Industrial Revolution

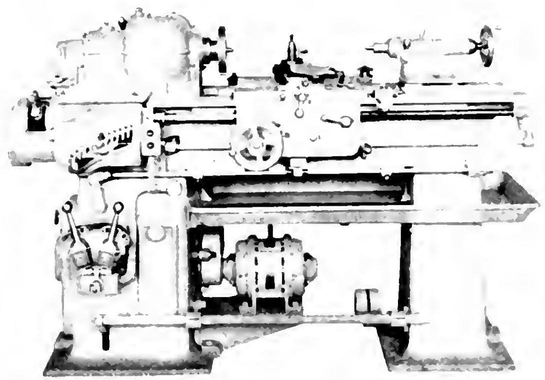
The immediate results of the Industrial Revolution afford ample proof of the foregoing statements. It will be remembered that the industrial workers of that period were devoid of protection, either by legal enactments or by mutual organizations. The first effect of the new inventions was a heartless enforcement of the first two influences discussed in the foregoing. The worker was torn suddenly, almost, from the ownership of the tools of production, and degradation of labor of the worst kind resulted. In a short time the textile workers were reduced to a condition comparable with the worst conditions of slavery. It is possible that the Industrial Revolution has been blamed somewhat unduly for the general conditions of industry of the time. England was constantly at war and that, itself, produces distress. And it was apparently a period of harshness and industrial depravity. What records we have of industry just prior to the period of change indicate that exploitation of child labor was common and there is good reason to believe that these bad conditions were partially responsible for the dreadful results that followed in the wake of the new inventions. As Professor Ely truly states:

> But whatever the causes, the facts that have been revealed regarding the conditions in English mines and factories of this period are amazing. The picture includes cruelty to apprentice children, excessive hours and unhealthy conditions of work. The evils were worst in the smaller factories, the owners of which were hard pressed by relentless competition. Outside of the factories also, those who attempted to work in their homes in the old way suffered from irregular employment and low wages. [illegible] affords an illustration.

It is doubtful, of course, whether any new inventions can so disturb the present industrial system. But it should be remembered that these tendencies still exist and are operative wherever labor saving machinery or labor-saving management are put into operation, and this serves to explain, partly at least, the resistance often offered to these innovations.

Economic Doctrine of Laissez-faire

There were other reasons why these conditions were permitted to exist. England was constantly distracted by foreign wars for which much money was needed. The new methods furnished an increase in exports and hence in revenue. But, perhaps, a more cogent reason is found in the viewpoint of the economists and political leaders of the period. It was the day of *laissez-faire*, that very comfortable doctrine, that these things were necessarily so, and if curable they would cure themselves. This view is clearly reflected in parliamentary debates of the time and naturally led to the free play in competition which marks the beginning of the present industrial era. The old laws of the mercantile system were not repealed, but became inactive, and the new conceptions of industrial legislation had not as yet come into being.



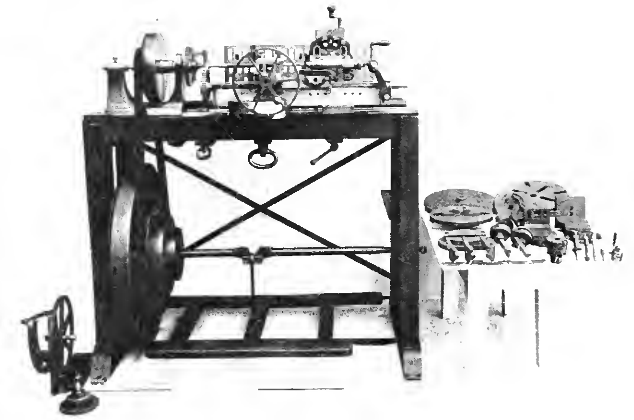
Courtesy of the Hendey Machine Company

FIG. 14. A 12 INCH BY 5 FOOT ENGINE LATHE, MODEL OF 1922

Compare this machine tool with its ancestor shown in Fig. 12. The mechanism in principle is the same.

Rise of Welfare Work

Any extended discussion of the reactive and corrective movements that naturally arose from the evils of the Industrial Revolution is beyond the scope of this discussion, but they will be discussed sufficiently to show their origin, and importance. As early as 1800, Robert Owen began his remarkable *individual* efforts to improve industrial conditions at the New Lanark Mills in Scotland. This experiment, which was most successful in every way, was the pioneer effort in "welfare work" as such individual attempts came to be known. While much of this work has failed through the lack of a knowledge of human nature there can be no doubt of the very great influence it has had upon our ideals. Every forward-looking employer today recognizes that he has a duty to perform toward his employees over and above any financial agreement that may exist, and the modern interpretation of this movement under the name of "Employees Service or Personnel Management" is a very important factor in industrial relations.



In the South Kensington Museum

Fig. 15 THE INSTRUMENT MAKER'S LATHE OF CHARLES BABBAGE

Note the modern appearance of many of the parts, particularly of the tools shown on the bench at the right. Charles Babbage is remembered for his integrating machine whose building was authorized and financed by parliament.

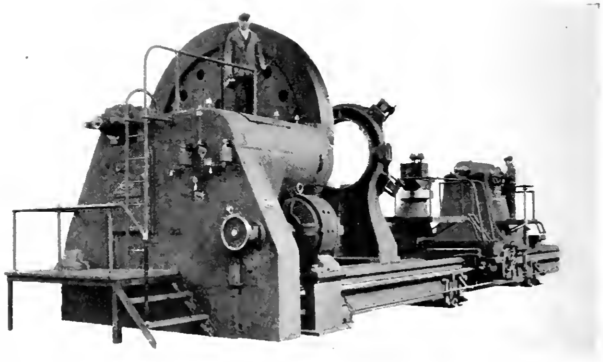
Beginnings of Modern Labor Organizations

Labor organizations also soon became a factor in industry. These modern organizations differ from the old guilds in that these latter were composed for the most part of master workers. But combinations of wage-earners had appeared before the new era and legislation prohibiting them had also appeared from time to time. As late as 1800, an English law forbade the existence of labor unions. This law was repealed in 1824, but it was not until 1875 that the English courts recognized the legality of such organizations. Notwithstanding the many instances where labor unions have been oppressive, the reasonableness of the right of workers to organize for mutual protection appears to be established. They are, no doubt, an essential factor in protecting the interests of the workers, and with intelligent leadership, which they have sadly lacked, their influence should be beneficial and not harmful. In any case the time has gone by when they can be legislated out of existence.

Welfare workers, like Owen and others, soon saw that the evils of the modern methods were not to be remedied by personal experiments and they soon sought protective legislation for the workers. In this they were joined by humane statesmen like Sir Robert Peel and others, and of course, labor organizations, as soon as they became effective, stood solidly for legal reforms.

Protection for Industrial Workers

The story of the change from the legislation of the Middle Ages to present-day industrial code is long and painful to read. It was not until 1891 that an industrial law was passed in England that in a fair measure at least offered protection to industrial workers. English industrial law has been, in a general way, until lately, the basis of American legislation. These modern enactments are a complete repudiation of the policy of *laissez-faire*. They assume that the national government is in duty bound to protect its citizens and to further their social and material well-being by every means in its power. It is true that the efforts of our national government in this regard often appear to be bungling enough, but the intent is good. No man who advocates the non-interference of the state in industrial matters has read industrial history carefully. We are committed to legal industrial regulation.

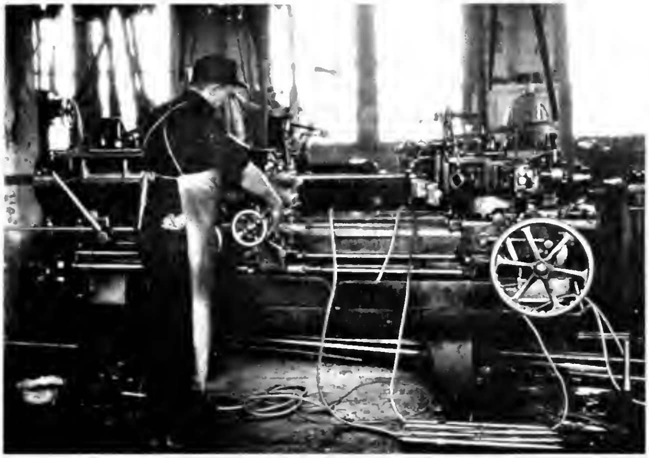


Courtesy of the Niles-Bement-Pond Company

Fig. 16 A MODERN 14-FOOT HEAVY ENGINE LATHE

This machine tool has a 50-foot bed and capacity of 34 feet between centers. Its size can be grasped by noting the figures of the man standing on the head stock and of second man standing on the foot stock platform.

These modern legal enactments are of two general classes. The first class has to do with the protection of the public at large against unfairness or danger from the various callings. Pure food laws, standard weights and measures, smoke prevention ordinances, state and federal commissions for the regulation of public utilities, and similar legal machinery illustrate very well this class of laws. The second class has to do with the protection of the worker himself against the dangers of his calling. The maximum number of hours of work per week, laws affecting fire hazards and sanitation in factories, and such laws as govern the age of minors in industry illustrate the second and most voluminous group of enactments. The most remarkable of this last group of laws is the modern Workmen's Compensation Act by which a radical departure has been made in industrial legislation.



Courtesy of the Warner and Swasey Company

Fig. 17 A MODERN TURRET LATHE

The job being done is turning a pinion shaft $25\frac{1}{2}$ inches long, $1\frac{7}{8}$ inches diameter of shoulder, $1\frac{1}{8}$ and 1 3/16 inches diameters of shaft. Cutting tools are carried both in cross slide and turret. Production time is about 30 minutes, material open-hearth steel.

Compensation for Injuries

Prior to 1880 no workman in this country could collect compensation for injuries unless he could show that he had not been *negligent* or *careless* and that his co-workers had not been guilty of *contributory negligence*. By the Act of 1880 this was modified so that he could collect damages even when his injuries had been due to negligence on the part of his co-workers. The Act of 1897 swept away these time-honored limitations and today the employer is liable for damages for injuries even when there has been no negligence on his part or on the part of other employees, and even when the accident is due to negligence on the part of the injured workman, unless such negligence can be [shown] as "serious and wilful misconduct."

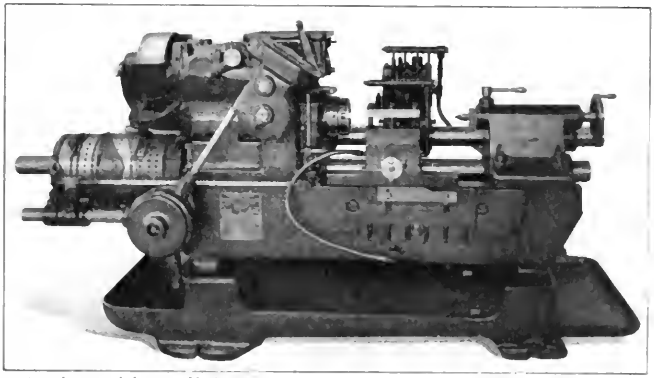
Mutual Insurance Plans

The principle of these new and humanitarian acts is that each industry should pay the cost of its own productive methods, and that neither the workman nor his family, who are usually poorly prepared to bear the loss of earning power, should be penalized for these accidents which are, as yet, apparently an unavoidable part of industry. The loss should be borne, as it now is, through mutual insurance plans by society in general.

Tendency to Extend Government Ownership

How far we shall go in thus regulating industry remains to be seen. The general tendency is toward more refined regulation with some tendency to extend governmental ownership, the *principle* of which has been admitted in the operation of the post-office. The *need* of such *socializing* regulatory measures cannot be doubted and we are not likely to return to the policy of *laissez-faire*.

[The September installment of Dean Kimball's series will show the development of industrial enterprises to the great size and complexity of many of our American undertakings. The operation of the great principles underlying industry which have brought this about have worked through two processes, consolidation and integration. Both of these are presented and discussed, leading to a declaration of the law of "increasing productivity."
—THE EDITOR.]



Courtesy Jones and Lamson Machine Company

Fig. 18. AN AUTOMATIC LATHE

Note particularly the cam drum or "brain wheel" at the left which controls all of the feed motions of the machine. One operator regularly runs two machines.

Synchronizing Sales and Production

By G. B. WHITE

Betterment Engineer, The Chambers Knitting Company

Class Number
658.412 Department Co-operation

THE great mass of manufacturing plants in this country are at neither extreme of doing a specialty or jobbing business, nor making goods for stock. We often hear the term, "the average man," but some authority has stated that he is harder to find than the exceptional man. In the same way the average plant can hardly be said to exist as a perfect specimen. But the great majority of organizations, containing a selling and a manufacturing unit, must continually compromise between the conflicting interests of the two departments in bringing co-ordination and mutual interest out of what might be chaos.

For some reason—I almost wrote some unknown reason—the average sales and production departments are lined up in opposing camps as if each held a champion boxer. What the production wants the sales to do is preposterous and what the sales says the production must accomplish cannot be done. Too often these disagreements degenerate into a chronic dog fight and each department bucks the other to a finish.

This condition can be wiped out in nearly every case by frequent meetings in which both departments are represented. Synchronizing the sales and production means, first, synchronizing the ideas of the men who sell and who produce. This having been done, keep them synchronized, and the problem is solved. Without synchronization the plant will be at sixes and sevens and the ultimate goal, profits, will be reached not by us but by our competitor who has realized the necessity of teamwork. I do not think I am going too far in writing that conferring is a more necessary step toward more and better business than perhaps any other that can be taken, providing neither of these departments is in itself hopelessly disorganized.

Meetings Must Be Tolerant

These meetings should not be allowed to become backbiting contests. When some defect in one department has caused difficulty in the other, a clear presentation of the difficulty and the best way to prevent a recurrence of the trouble should be shown. The chairman should be tactful and pleasant, but should quell any conflagration before it has a chance to get a good start.

Where the plant is manufacturing a definite line of product, whether seasonal or the year around, both departments have an almost equal voice in regulating the production.

First, the sales executives, basing their views on their past experience, and if possible, on current investigations, tell what they want and put a proposition on each article, line, and style.

Second, the production departments come back with information as to their capacity to produce these items, stating whether they can meet the demands for the number called for. They also call to the attention of the sales department any gaps the latter have left. Frequently, some production units will be left idle under this first draft and means for putting them to work must be discussed.

Our accounting friends have been strenuously agitating a budget system in all business. The production schedule is, in the last analysis the same thing—a production budget.

We must remember that a budget, whether in the financial or the production end of a business, is not a hard and fast setting forth of requirements. Unlike the laws of the Medes and the Persians, it is possible to change it. Frequent and sometimes drastic changes are indeed necessary.

Again the sales department will say they can sell so much of such and such goods, if they can be produced for a certain price or lower. Specifications may have to be trimmed. Or, to the joy of the salesmen, the production end may find it can put in a few frills for the same price.

The Question of Deliveries

Then the production department comes back with the question of deliveries. Perhaps more hearts are broken and more service endeavors wrecked on this rock than any other.

We all will grant that it is hard for a salesman to walk out without an order because he knows he cannot deliver on the date which the prospect specifies. On the other hand, suppose he takes the order and the customer gets excuses instead of goods. It will be much harder for that salesman to walk out with an order in the future, than without it this time. So this question of deliveries must be fully threshed out in these joint meetings. Some method must be laid out for setting dates that can be met, and for meeting them.

Finally it is up to the sales department with all the information on the table to set quotas for the salesmen. The first time this is done, it will be with much heart-searching and fear. If, however, the sales department uses the great mass of information available as to finance, crops, weather, type of consumer, and other conditions, and takes into account the capabilities of each salesman as well, a quota can be set which should fairly represent what should be expected of each man. The second time it will be easier, and the next time still easier, but it should never be allowed to degenerate into any set of fixed rules because all the conditions are variants and must always be examined afresh.

The production budget and sales budget are both now in shape to be placed on paper. The sales department must realize that if it falls down, it means trouble in production, which will eventually come back to itself. In the same way a fall down in the production roughens the road of the sales department and eventually causes gray hairs on the production men.

The Measurement of Management

Some Concrete Possibilities from the Engineer's Viewpoint

By FREDERICK J. SCHLINK

Mechanical Engineer, Physicist

MUCH has been written of late on the need for the measurement of management. It is growing more and more evident that industry must seriously study its own weaknesses and their underlying causes. The public is beginning to question many things that are regarded as accepted business methods; it is not so certain as it once seemed to be that very high salaries or enormous commissions are necessary to attract the most capable managerial services; or that very large dividends are requisite to secure adequate investment in industries in which, properly managed, no particular risks are inherent.

Business and industry must seriously question the validity of their own expedients and devices just as the physicist and chemist are constantly re-examining their hypotheses and modifying or elaborating or replacing them as the new and growing bodies of fact require it. It is impossible consistently to improve present methods until we know their weaknesses. Most of the improvements and important new developments in the tools and instruments of industry have directly followed investigations into the faults of those already in use. We now have fine watches, and thermometers of incredible precision, only because each new instrument of the type was examined, tested, studied in theory and in use, until the defects were all seen and catalogued and their relationships known. Fifty years ago no one would have imagined a pocket-watch accurate to a second a day, accuracy to approximately one-thousandth of one per cent; yet today such watches are common— and useful. To explorers, navigators, and engineers they are almost indispensable.

"How well am I doing my job?" is the most insistent question that an executive must face. Upon the answer depends his position, his future, perhaps his fortune, and the continuation of the business as a successful venture. Directors, stockholders, employees and the public are all vitally concerned with the result. A measure of management ability is becoming as necessary to industry as the many precision instruments are to science.

Some have said that it is impossible really to measure management; that there are a myriad of factors to measure; that no two enterprises are enough alike; that the measurements if they were possible would be too costly to pay for the trouble; that it is impracticable to devise any suitable system of units; that after all, costs and profits are all we need to measure management for practical purposes.

All of these attitudes, though plausible enough at first glance, fail to stand the test of engineering analysis. There are a myriad of factors to measure if we wish to measure all of management, but fortunately no such problem is before us. As well say that there are a myriad of factors to measure in power transmission lines. There are, if we try to cover too much ground. It is hardly possible to measure in any reasonable time all the factors that determine the performance even of a single transmission line, but a corps of engineers can arrive at a pretty good result, including all the more vital factors, in a few days. Of course, we are helped enormously by the existence of extensive resources of research data and scientifically developed methods that make unnecessary a great many false motions and needless refinements. In measuring managements also, the research work must be done as a groundwork before the problem becomes easy and direct.

Engineers are now making, daily, measurements of such refinement and precision as would have been impossible to the physicist and chemist working with the most superior equipment and skill in the best laboratory environment, a decade ago. A single instrument or device developed as a result of research may make possible an enormous multiplication of our power or skill. There is every reason to suppose that such instruments and devices will appear in the field of management as research is undertaken and accomplished. Certainly they never will appear unless a beginning is made in the direction of real research.

The measurement even of obscure mental and physiological phenomena is being rapidly set on a firm basis, with the most promising results. It is possible now to measure the process of digestion, and the influence upon it of mental attitudes, such as pleasure, fear, pain, etc. Management is likewise the product of measurable physical and psychic factors, and we are just as likely to find an underlying science and technique applicable here, as in any other field of modern research.

While there is every probability of a solution to the problem of measuring management, there is no likelihood that the method will be simple, or that it will depend upon the observation of a single convenient magnitude, any more than it is possible to predict the life of a tire by a single measurement, as of hardness, expansibility under pressure, weight, or cost.

An industry is often spoken of as well-managed because it pays large profits or operates on a small investment. Neither size, operating income, capital investment, profits, amount of pay-roll, the number of stockholders or any such convenient item or combination of such items will ever afford a measure of management. As well try to evaluate a power distribution network by the profits made by the power plant whose energy it distributes. The function of management is analogous to that of the channels of transmission in a power plant: the water- and steam-pipes and valves in the central station, the interior cables and switchgear for interconnection of units and connection to the external distribution system, and the external primary distribution system. Whether the enterprise pays a large profit or none at all depends upon some factors, such as the design and arrangement of these elements, over which the engineer has control. It may depend far more on points such as obsolescence of equipment, or abnormal cost of coal or of transportation, factors which if they exist in certain practical combinations may be beyond the control of the management or the engineer.

Measurements at Many Points

The management of an organization, like the pipes, valves, wires, and switchgear of the plant just referred to, constitutes the channels of communication through which the plans and practices laid down by the executive head of the organization (who in turn is responsible to the owners and the public) are delivered or circulated to the ultimate point of production—workmen, tools, machines, and materials of production. If we keep in mind the thought of the managerial staff constituting primarily a network of co-ordinated channels of communication, we shall not make the error of assuming that its performance can be measured by any such factor as profits, or earnings. We must measure its performance in terms of the individual functions performed by the several parts of the system, and the efficiency of such performance in terms of energy delivered for effort expended. Whether the delivered energy produces the desired profitable result is the factor that determines profits, and is a question quite apart from the efficiency of the managerial system as a system of communication. In other words it is the service performed and the physical and mental, not the financial results obtained, which determine the true effectiveness of our process as a process (not as a business).

With this in mind we see that fundamentally, in order to measure management, we must apply a device or instrument, or perhaps several of them, at every point where physical or mental energy is being transformed into another form of energy (or into material goods), to determine the character and efficiency of that transformation. The profitableness of the result will be increased by an efficient process, if that process belongs where it is. If it is the wrong process applied to the objective, the profitableness of the business may actually be decreased by efficiency of management at this point.

The local misdirection of management may be the fault of a primary misdirection originating at some point higher in the management hierarchy or it may inhere in the nature of the enterprise, and the responsibility lie at the door of the owners or of the consuming public. To make this more concrete assume that some unethical sales policy is employed, perhaps must be employed in order to market the article at a profitable rate. Then the more efficiently this wrong policy is carried out, the worse for the business in the long run, if commercial honesty really pays, and continued dishonesty effectively reacts on financial success. This is mentioned only to drive home the point that 100 per cent efficient management may result in a very unsuccessful business; that to measure *management* is one thing, to appraise a *business* as a profit-making enterprise is quite another.

Some Well-Managed Organizations Pay No Profits

The examination of management on a basis of profit instead of services leads us to palpable absurdities. The great technical and scientific societies, the Bureau of Standards, the Post Office Department, the great city hospitals, either barely self-supporting or less, perform indispensable services, under excellent management, in many cases; yet some measures of management that have been proposed would rate them all at zero or nearly zero efficiency. If profit is the measure of management then a telephone or telegraph company or the express office having a monopoly of the business in its town need pay no regard to its customers' complaints or requirements except under compulsion by the public utilities commission, if any, having jurisdiction, since business courtesy cannot substantially increase its returns, there being in the case of the post office and the telephone monopolies no likelihood of present or perhaps even remote future loss of business through competition.

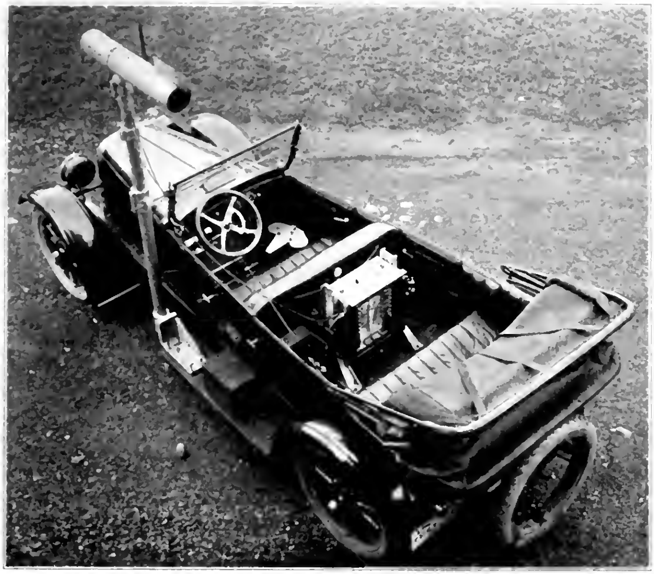
On a profit basis there could be no measure of the management of some departments of any research laboratory, where always and essentially some of the problems undertaken find no commercially successful solution, sometimes after years of work. What one writer terms the "difficulty of the situation" is here indeterminate, and may in fact be practically infinite in a given case. Yet the real measure of management remains, and that is the product of quality and quantity of service rendered, per unit outlay; the service rendered not being the profit-making discovery or invention toward which the work may be ultimately directed, but the work of research itself—the intelligent pursuit and co-ordination of the efforts toward the goal, not the goal itself.

There are certain characteristics common to all management regardless of the particular goods or services which it delivers; this is the common territory of all industrial enterprise which makes the measure of management a possibility. These characteristics are common to all good management, even the most humble foremanship. It is impossible to present a complete general analysis, of course; this part of the problem alone will require a great deal of individual and co-operative study.

To measure management, we must treat it as we do a power distribution system, but transmitting policies, directions, and orders, and providing supplies and materials, instead of electric currents. We must apply a "meter" or a combination of meters at every point where the energy is transferred or transformed, one or more to measure the input to this point, others to determine the nature of the transformation taking place at the point, and still others to determine the output delivered beyond the stated point. To see what a problem the measurement of any single energy transformation may involve, consider the case of the test of a gas engine, which involves the transformation of the stored chemical energy in the gas or oil into the mechanical energy of rotary motion at the belt pulley or drive shaft or propeller shaft or wherever the power is normally delivered for use. To measure the input and output we must measure, according to the draft of the "Test Code for Internal Combustion Engines" recently published in preliminary form by the American Society of Mechanical Engineers[1] the following items:

(a) Cylinder diameter, stroke and clearance [illegible] ing cylinder.
(b) Diameters of piston rods and tail rods in working cylinders of double-acting engines.
(c) The brake horsepower or [illegible]att horsepower output.
(d) The kilowatt output if engine is direct connected to a generator.
(e) The speed in revolutions per minute.
(f) The horsepower to drive the water-cooling pump and fuel pump (if any).
(g) The horsepower to drive the independent scavenging pump or blower.
(h) The horsepower to drive the independent injection air compressor.
(i) The amount of fuel supplied; cubic feet of gas for gas-burning engines, or pounds of liquid fuel for liquid-fuel engines. If more than one kind at the same time, the amount of each kind.
(j) The calorific value of the fuel, high value.

In addition to these ten items, there are 32 other items ranging from: "(*a*) Cylinder diameters and strokes of injection air compressor" to "(*af*) The compression pressure in cylinders when hot and cold, at normal or at reduced speed at wide-open throttle."



Courtesy of the Bureau of Standards

FIG. 1. INSTRUMENT EQUIPMENT OF AN AUTOMOBILE READY FOR ROAD TEST

The apparatus includes devices for measuring and in some cases autographically recording accelerations, velocity relative to the wind, direction of the wind, power output of the engine, rate of fuel input to the engine, air consumption of the engine, engine speed, car speed, temperature of inlet and outlet cooling water, reduced pressure in the intake manifold, temperature of lubricating oil, temperature of air entering the engine, and position of the spark control.

To make these measurements, *13 different kinds of instruments* are required, including weighing scales, planimeters, pressure gages, indicators, revolution counters, absorption dynamometers and others. See Fig. 1.

A whole column is devoted to instructions and precautions for the use of two of these instruments (the indicator and the absorption dynamometer).

To the calculation and recording of results, two pages of text are devoted, and the form for recording the data comprises two tables, one of 74, and the other of 25, named and numbered items, several of these involving a number of sub-items.

As is unmistakably evident from these examples, it is out of the question to provide any single instrument or device to be applied at some point of the energy transforming system, that will enable us to measure the efficiency of the complex.[2]

[1] *Mechanical Engineering*, March 1923.

[2] In point of fact it usually requires in the simplest kind of case, two instruments or at least two measurements to determine the flux of energy into a point, and two others to measure the flux beyond the point, one to determine the amount of the medium transferring the energy, and the other its potential or pressure or elevation above some zero level. Thus in measuring the efficiency of a simple electric motor we measure input as the product of amperes (amount of current) times volts (potential of the flow); and output as revolutions per minute times 2π times the radius of the brake drum (*amount* of motion) times force at the periphery of the brake drum (potential or intensity).

Similarly in measuring management, we may arrive at an entirely erroneous conclusion by a single measurement or even after a second and a third measurement. *It is only by a succession of measurements, each suggested and guided by a prior observation or determination, that we can arrive at a true knowledge of conditions* when some of the facts are concealed from direct examination by an external structure or personality or organization.

An amusing story appeared in a popular magazine recently of which the central idea was that of an executive and business man of wealth and position who tried, incognito of course, to secure an executive position through his own employment service, and experienced a most discouraging turn-down coupled with a sardonic and arrogant discourtesy sufficient to humble a university president. Many an able executive would find himself in a similar position were he to try to re-enter his firm's employ through its employment office. Here's where the test of management comes in; if the employment office really functions correctly and in a way to enhance the management, it will recognize the kind of ability that accords with the established methods and policies of the organization. Let the chief executive send a trusted acquaintance or friend of known high qualifications to the employment department as an ordinary applicant for a position for which he is certainly very well qualified. See what sort of treatment he gets; what appraisal is made of his ability; what salary value is placed on his potential services.

Similarly a development or patent department can be given a most critical test by being given opportunity, by mail, or by personal interview to examine an invention, perhaps one known to be commercially successful, practical, and efficient, but in some particular foreign country, so that it would not already have come to the attention of the patent department under investigation. If such an invention is turned down, or dismissed with only a careless examination of its possibilities, it will provide data, if reinforced by two or three other instances of similar character, that will enable one to rate the services of the development department almost with mathematical precision.

Satisfying Customer's Requirements

A few practical, clearly-stated complaints, directed by members of the executive staff to the complaint or adjustment department of the organization, but in the names of other persons, as patrons or customers, will give very precise information as to the way in which the company's established policies in the matter of satisfying its customers' requirements are being carried out.

Or let a supposed prospect write to the sales engineering department for technical information; it will be as easy to grade the reply quantitatively, if the questions are well devised, as to grade an examination paper. After all, that is exactly what this method proposes—an examination which the person examined does not know he is taking. The result is that, on the average, and allowing for temporary ups-and-downs of feeling and temperament, he will write down his own ability in, and his personal and professional attitude toward, the position in which he is functioning. It is a method which makes a measurement without appreciably distorting or modifying the quality being measured. This is an effective way to keep an organization from developing into the rigidity and arrogance of a bureaucracy, which is a tendency that many alert executives note and deplore in the development of certain departments, especially those that come into direct contact with the public.

If a suggestion system is run on a basis which does not permit those to whom the suggestions are routed to know of their origin, it is quite possible to test its functioning by having the general manager, or chief engineer, or the vice-president, offer a demonstrably well-directed sound suggestion occasionally. When this method is applied and it is found that the sound suggestion is given unintelligent consideration, or choked in the machinery, a few well-chosen words from the chief executive directed to the persons at fault will remedy the difficulty in amazingly short order. It is much more essential to make an example of such cases than it is of a workman caught stealing tools or material. The suppressor of sound suggestions steals a large slice of the company's good-will, if he does it with deliberate intent to repress useful information, and may cause large direct losses in preventing or delaying adoption of improvements in organization or routine.

Quality and Quantity of Service

It seems certain that the real test of management must be the quality and quantity of service rendered per unit of material and personal outlay, including the supporting charges or carrying charges on each of the latter two. The formula shapes itself as follows:

$$\text{[1]} \quad - \; - \; - \; - \; - \; - \quad M = \frac{kn}{E_m + E_p + C}$$

M, the measure, or more loosely, the efficiency of management, is equal to k, the quality of service (on a basis of perfect service=unity), times n, the amount of service rendered (the money value if this is known); the product divided by the sum of the material, E_m, and personal expenditure (supplies and services), E_p, plus the interest, rent, insurance, administration and other charges, C, on the goods and services of the first two terms of the denominator the units of each term of the denominator being dollars.

A very rough outline of personal qualities in a supervisor that should be appraised in a quantitative way in making a measure of the personal qualifications of managerial employees is shown in Table 1. The qualities shown are desirable, contrasting—not opposed—qualities. No effort has been made to set down a scale of relative weights for these qualities. As will appear later, that is a task for expert co-operative investigation and development.

If we wish to arrive at a quantitative estimate of the operation of two railroads, A and B, regarded from the viewpoint of the lay passenger, traveling between the same two cities, and not considering factors other

TABLE 1. PERSONAL QUALITIES FOR A SUPERVISOR

Stability

Ability to stand criticism
Recognition of advantages of standardized methods, tools, and processes.
Firmness in carrying out decisions maturely arrived at.

Independence

Ability to work alone, to make the most of local resources.
Resourcefulness.
Acceptance of personal responsibility

Intellectual Honesty

Performance of work by direct methods, not by indirection.
Solution of management problems by the method of the engineer, not of the politician.

Courage, Open-Mindedness

Willingness to offer criticism when due.
The research attitude (in a minor supervisor, willingness to try new methods, tools, ideas, and not to argue stiffly against them).
Study of the literature of the art or science; use of accessible resources of laboratories and libraries.

Co-operativeness, Team-Play

To accept minor losses for the general advantage.
To refrain from insistence on mere prerogatives.
To interpret management in both directions, from the workmen to the higher executives and from the executive authorities to the workmen.

Tact

Courtesy.

Educability

Willingness to be instructed.
Readiness to see and understand policies and directions.

Educativeness

To explain the why of decisions so that they will be carried out with the head as well as the hands. To encourage and develop in others initiative and the investigative attitude.

than those directly observable without special inquiry or investigation, we may set down some such tabulation of the apparent essentials of service as in Table 2.

This table can lay no claim to correctness in any of its details either as to the items of service that should be rated, or the relative weights that should be given the several ratings. It will serve, however, to indicate the ease of applying the principles and will make evident the practical usefulness of the scheme. There is no doubt that as management develops, some such ratings will be applied to many public and private services such as hotels, theaters, telephone and telegraph systems, newspapers, taxicabs, ticket offices, and public garages and service stations.

In a recent article,[3] by J. Howard Matthews of the Illinois Commerce Commission, is described a comprehensive, fully developed scheme for periodic rating of public utilities, which is said to have worked with very satisfactory results in grading the services in about 700 localities served by electric central stations. Table 3, taken from Mr Matthews' paper applies to electric utilities, being a typical rating showing the basis of computation used

[3] *Electrical World*, Vol. 81, No. 18, May 5, 1923, p. 1034.

TABLE 2 RATING SCHEME FOR RAILROADS

(Illustrative only)

Item of Service	Relative Weight	Quality of Service		Quality Weighted	
		A R R	B R R	A R R	B R R
Lowness of fare	0.20	0.8	0.9	0.16	0.18
Shortness of running time	0.25	0.7	1.0	0.18	0.25
Ventilation of tunnels	0.05	1.0	0.6	0.05	0.03
Lighting of trains	0.05	1.0	0.8	0.05	0.04
Restaurant meals and service	0.10	0.5	0.9	0.05	0.09
Courtesy of trainmen	0.05	1.0	0.9	0.05	0.04
Smoothness of roadbed.	0.05	0.7	0.8	0.04	0.04
Convenience of departure and arrival times.	0.10	0.5	0.9	0.05	0.09
Reliability of schedule.	0.10	0.9	0.7	0.09	0.07
Skilful handling of trains.	0.05	0.3	0.8	0.02	0.04
Total	1.00				
				0.74	0.87
Totalized relative rating of service the factor k in Equation 1				74 per cent	87 per cent

TABLE 3. RATING SCHEME FOR ELECTRIC CENTRAL STATION SERVICE

Condition of Service	Weight	Grade	Weighted Score
Continuity of service	30	89	2670
Voltage regulation	15	80	1200
Handling of complaints	10	80	800
Meter testing	7	95	665
Consumers' attitude	5	80	400
Provisions for emergency	3	60	180
Adequacy of capital	2	80	160
Construction of distribution lines	2	80	160
Maintenance of distribution lines	2	75	150
Extension policy	2	95	190
Furnishing new service	1	95	95
Adjustment of bills	1	100	100
Billing	1	90	90
Grounding of secondaries	1	60	60
Total of service	82		

Records	Weight	Grade	Weighted Score
Record of interruptions	5	60	300
Voltage surveys and records	5	20	100
Records of meters and tests	4	80	320
Record of complaints	4	0	000
Total for records	18		
Final grade			76.40

Schedules are provided setting up a definite basis for determining the individual grades, due allowances being made for defects of service occurring at hours or under conditions when loss to the consumer is unlikely or slight (as interruptions in lighting services after 11 at night). Graded penalties are provided for lack of reserve equipment, ranging from a complete lack of such reserve, to zero penalty for a plant having two adequate transmission lines and a standby plant under steam. The form and adequacy of records of voltage surveys, meter tests, and complaints kept by the company are included in the rating. Ten different detailed terms involved in the manner of handling complaints are considered, for example, in rating the company on this feature of its service.

This certainly exhibits a most ambitious and creditable endeavor to measure management on a large scale and in enterprises of enormous aggregate financial value. It seems certain that the evident advantages of the quantitative method will bring about its rapid extension to many other utilities, such as telephone and telegraph, and ultimately to large private businesses.

To arrive at a proper scale of weights for the various factors entering into service is a problem of the greatest difficulty and one which can never be solved by individual effort to the satisfaction of all interests concerned. In this respect, it is closely akin to the engineering standardization work done by a good many of the national technical and trade associations under the procedure of the American Engineering Standards Committee.[4] Standardization of the factors of management, like those of machine design and safety engineering, cannot be done effectively by any individual or even by a single trade or technical association. The result must be reached by the conference and co-operation of all essential interests concerned—producer, consumer, and those representing the public welfare.

Management Research Data Needed

In order to permit management to make progress in measurement, certain research data are needed. A few points of investigation readily suggest themselves:

1. How far may routinization (rigid methods of work, requirement of regular quantity of output, etc.) of intellectual processes such as machine design, specification, report and advertisement writing, proof-reading, be carried without actual loss of efficiency due to discouraging initiative, stalemate?
2. By what tests of intelligence and disposition may employees be selected who are best adapted for routine duties and least unhappy in their performance?
3. Every art requires a nomenclature before its measurement can be put on a firm basis. Reference to the difficulties involved in vague and variable nomenclature in personnel management will be found in the May issue of MANAGEMENT ENGINEERING in papers by Arthur H. Young, in relation to standardized occupational names, involving over 900 definite trades and crafts with definitions and itemized outline of qualifications of each; by J. P. Jordan, in relation to costing terminology; by J. D. Hackett, in relation to standardization of terms involved in the labor contract, by development of a special glossary of such terms.

[4] The author is Assistant Secretary of this Committee.

In the conduct of management research there will be many to advise purely practical methods, taking ordinary, everyday conditions as the basis of measurement, rather than standardized, ideal conditions where every essential factor is known and controlled. The practical method will not lead to the result that is ultimately the most useful. The researcher deals with pure reagents, known conditions, isolated phenomena, because the results so obtained are reproducible on other occasions and can be combined in new ways, whereas the more practical method solves only the immediate problem and is not readily adapted to the analysis of a new complex of conditions.

As a concrete instance, it might be argued that we should test a telephone receiver in a somewhat noisy environment because that is how it will normally be used. Yet it would be quite impossible to determine the law of action of the receiver under noisy conditions, and it is an actual fact that great pains and ingenuity are shown in obtaining situations substantially free from extraneous sound, in order to carry on satisfactory and reproducible tests of sound-radiating instruments and devices.

Some of the great mail order houses have built up large and preeminently successful businesses on a "money back if not satisfied" policy based on the principle that the public on the average is honest, or at least that if it is not honest, the number of people who do not complain about unsatisfactory goods is enough to compensate for those who complain unjustly and without due cause. It would seem that somewhat the same principle should apply and with far greater force to a company's employees, who are selected individuals usually closely supervised by each other and to some extent by the public with whom they come into contact; and that on this account much of the money that is expended in investigations into the purely pecuniary side of the business and the financial responsibilities of collectors, cashiers, etc., might better be invested in investigations of service. Company sleuths looking for "knocked-down" fares, or resold tickets, are common enough, but it is rarely that one hears of a motion-picture theater executive doing a *field* investigation to determine how well satisfied his patrons are with prices and quality of attractions. Yet these latter factors are what the public understands.

These points, though developed only in bare outline, may serve to indicate some of the possibilities of research applied to the measurement of the flow of energies in management. From an engineers' point of view it often seems that many costly checks and controls common in business practice represent expenditures that might far better be devoted to positive investigation and accomplishment designed to bring about permanent amelioration of a situation, rather than merely a day-by-day meeting of its routine requirements.

Measurement of management will go forward by the successive isolation and determination of one point of control after another, and finally by the synthesis and co-ordination of these into a unified type system of measurement. In due time, no doubt, we will have the management equivalent of the mechanical engineers' system of power test codes.

A $200,000 Saving in Factory Costs

And Other Advantages from Controlled Production

By H. L. BENEDICT

President, Benedict Manufacturing Company

ABOUT the most discouraging situation that can face the owners of a business is to find the factory unable to ship the orders that the sales department gets. That was the condition we were in prior to 1919. In bad times we could not sell all we could make; in boom times we were unable to even up by shipping all we could sell.

Our plant, whose principal product is silver-plated ware, was congested as a whole, and yet certain departments were practically never up to capacity. That seemed to indicate an unbalanced condition. To expand the plant seemed to be the only way by which we could boost our production sufficiently to meet the increasing demands for our product.

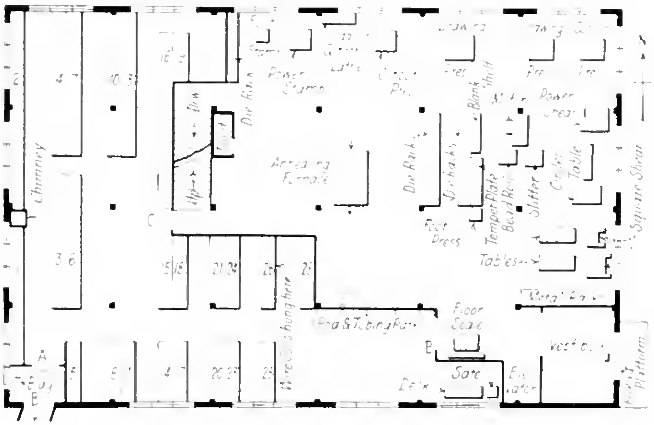


Fig. 1. A New Arrangement of the Stores Department

In fact the several plans we had considered all called for additions to the existing buildings in order to increase our floor space. These additions would have called for an investment of between $40,000 and $50,000.

We wanted production and yet we were disinclined to spend so much money, especially as it seemed foolish to add modern buildings to our old ones which were already somewhat crowded on an odd-shaped lot.

Our Manufacturing Problem

Our need stated in the form of a manufacturing problem to be solved was: To increase the production of goods, if possible, without expanding our plant; to reduce the value of goods in process; and to lower factory costs.

After consideration of various possibilities we decided finally to get the advice of industrial engineers. We wanted first of all, to find whether anything could be done to give us the production we needed without spending money for new construction. If new buildings were required we wanted to get the best we could for the money to be expended.

Needless to say we already had some rather definite ideas on what was needed, which, however, we kept to ourselves, for we wanted the fresh ideas of outsiders untinged by what we thought. The results justified us in this, for their investigation found a solution of our problem which had not occurred to us, and which gave us the capacity we wanted with no expense for new construction.

The Solution of Our Problem

Briefly the changes included some rearrangement of machines, departments, and storerooms; improved work benches in some departments and a little new equipment; and an effective method of controlling and planning production.

The broad results, which have become permanent advantages, are:

1. The release of 25 per cent of our floor space.
2. Working hours reduced one hour per day.
3. Employees increased 3.5 per cent; wage earnings 20 per cent.
4. Production increased from 15 to 52 per cent.
5. Factory costs reduced 20 per cent.
6. Material turnover increased to 1.31 per month, with a reduction of $130,000 in the value of goods in process.
7. Lower costs have saved us $200,000 to date.

Our plant is an old one, which has been added to piecemeal to take care of increased business. This naturally resulted in an unbalanced condition with some departments overtaxed and others overdeveloped.

Our buildings are of unusual shape, partly because of the triangular shape of the plot. Therefore it seemed impossible to achieve the desirable straight-line layout in which materials are received at one end of the production line, pass through the productive departments with a minimum of backtracking, and are shipped from the other end. This very arrangement was secured by a different disposition of the departments.

PRODUCTION ROUTING SHEET

DATE ____ PART NAME ____ MATERIAL ____ GA ____ CATAL NO ____ PART NO ____

NO	OPERATION NAME	DEPARTMENT	MACH OR EQUIPMENT NUMBERS	TOOL, DIES OR CHUCK NUMBERS	PRICE SET UP	PRICE PIECE	SET-UP TIME	TIME PER 100
1								
2								
3								
4								
5								
6								

Fig. 2. FORM OF PRODUCTION ROUTING SHEET

This is how we secured the needed 25 per cent more floor space without new building.

Our old shipping department was well located, but too small, and there was no room for additions. Our general stores department was placed directly back of the shipping department which brought it in about the center of all manufacturing. It could not be enlarged, which necessitated storing some materials at several different points. This, of course, prevented satisfactory control of stores; a most important consideration in controlling production. We needed twice as much storage space as we had available. The biggest problem we had, however, was the congestion in our largest manufacturing department. The solution of our space requirements was found in a two-story building at the far end of our plant, the first floor of which was used almost entirely for the storage of packing materials and of slow, obsolete stock.

Our first step was to dispose of the slow-moving and obsolete stock. The packing materials were taken from the two-story building and placed near the shipping department. We then had the first floor of this building for general stores and for productive departments, which relieved all the congestion and gave us the needed addition to floor space.

The shipping department was enlarged about 75 per cent by the addition of the old storeroom space which was made available by moving the general stores to the first floor and basement of the two-story building. The new stores arrangement added more than 100 per cent for stores purposes and made possible the desired control.

The cutting department, punch presses, and annealing equipment were then removed from the large manufacturing department and located next to the storeroom. The operations performed in these departments were the initial ones, and the location near stores permitted the material to be handled on an economical basis.

This rearrangement relieved the congestion in the large manufacturing department so that an entirely satisfactory balance in equipment and in floor space was obtained.

An elevator was installed in the two-story building which speeded up considerably the delivery of finished product from the initial operations to the main manufacturing department where all other operations, previous to plating, are performed. The layout of the new stores department and the lineup of the machines for the initial operation are shown in Fig. 1.

Other savings in space were made through the introduction and rearrangement of standard racks, a new design of soldering bench, and relocation of partitions.

These changes in themselves were most effective; they were essential to the best functioning of the production planning methods which were later installed. I think that is a point worth stressing, for I know from observation of other plants that the best paper system of production control will not give a smooth flow of work through a shop if the plant is physically badly arranged.

FORM SM 8-1-18

TOOL RECORD

No.

NAME OF TOOL ____

DESCRIPTION ____

USED ON MACH. NOS. ____

NO. PCS. TO TOOL ____ DATE MADE ____ ON ORDER ____ B.P. ____

USED FOR

PART NO	CATALOG NO.	DESCRIPTION OF PART	OPER. NO.

Fig. 3. FORM OF TOOL RECORD

While these changes were under way the engineers were at work devising the production planning methods which seemed best adapted to our peculiar needs. Our organization was trained, little by little, in the operation of these new methods of scheduling production. The engineers recommended that the changes be made gradually rather than all at once, so as to reduce to a minimum the confusion that comes with radical changes. There was, of course, some confusion at first, but within three months the new methods were operating smoothly and production was increasing. The production planning system operates as follows:

ARTICLE ____

STOCK INVENTORY SHEET

UNIT	SIZE	MAX.	MIN.

CATALOG NO ____

PART NO. ____

ORDERED			RECEIVED				RESERVED			BALANCE	ISSUED				ISSUED			
DATE	ORDER NO	QUANT	DATE	ORDER NO	QUANT	PRICE	DATE	ORDER NO	QUANT	AVAILABLE	DATE	ORDER NO	QUANT	BALANCE ON HAND	DATE	ORDER NO	QUANT	BALANCE ON HAND

Fig. 4. FORM OF STOCK INVENTORY SHEET

It was first necessary to know definitely just what operations are needed, and in what order they should be performed. This information is given on the production route sheet shown in Fig. 2. The headings on this record describe sufficiently well the information recorded.

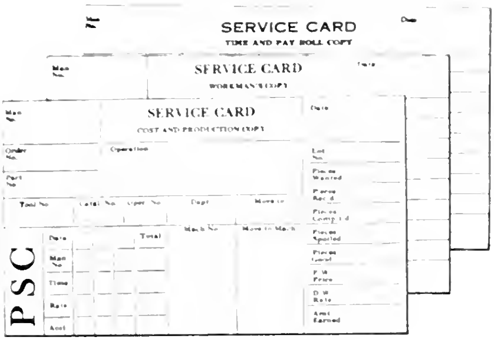


Fig. 5. FORM FOR PRODUCTION SERVICE CARD USED TO ACCOUNT FOR DIRECT LABOR

A tool record (Fig. 3) was developed, on which are recorded all tools, punches, and dies, and the use to which they are put.

Since absolute control of material is essential to production planning a perpetual inventory record was developed and put into operation. (Fig. 4.) All withdrawals of materials and supplies are authorized on requisitions which are also used in accounting. As these forms are of the usual style they are not reproduced here. Productive and non-productive service cards are used in order to account for all labor. The productive service card provides all information as to time and quantities produced, goods defective, etc. These cards are shown in Figs. 5 and 6.

Each job is released to the shop according to schedule. When the time approaches for a new job to start, the requisitions, traveler, and service cards are released to the shop by the central planning department. The requisition goes to the storeroom and serves as notification to the stockkeeper to release the material and deliver it to the first operation. The service cards go to the departments which will be called upon to work on the job, and warn them that it will soon be ready. The traveler (Fig. 7) continues with the job throughout its journey through the shop.

Daily the requisitions and service cards are returned to the production department to keep it informed as to the progress and exact location of every part in the process of manufacturing. This information is recorded by the production department on the operation check sheet (Fig. 8). As the record was developed and kept up it soon showed us where delays occurred so that we could overcome them and keep production moving constantly.

To give close control, a production booth, equipped with plan boards and in charge of a production clerk, is provided in the shop. At first the production department required the service of four additional clerks. After the machinery of the production [illegible] properly functioning, we reduced this [illegible] now find that two additional clerks are [illegible] needed.

We also added four helpers in our shops [illegible] producers. This allowed the producers to g[illegible] the[illegible] full time to production, whereas formerly they had had to spend some time in finding their own materials, tools, and so on. These additions to the force did not increase our overhead as might be expected because the service rendered helped to increase the production and so lowered the costs considerably.

While we were experiencing the increase in production, we reduced the working hours for all of our employees by one hour per day. The production still continued to increase.

The changes in our methods gave us the production we needed. That is the big thing. And we are glad to give credit to the engineers, Miller, Franklin, Basset and Company for their counsel and advice. The specific results are here given in detail:

Before making the changes we had 227 employees on our pay-roll. When the work was finished we had 235, an increase of 3.5 per cent.

Under the old, congested conditions, and with production unplanned, our average monthly production had been 34850 units. For the first six months of operation

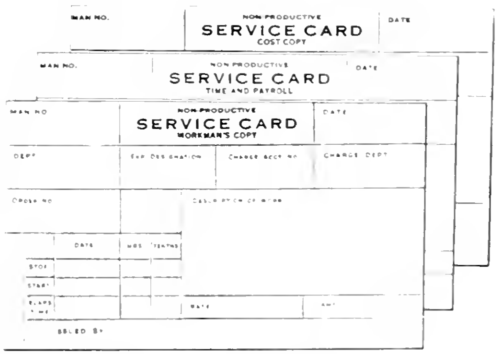


Fig. 6. FORM FOR NON-PRODUCTIVE SERVICE CARD USED TO ACCOUNT FOR INDIRECT LABOR

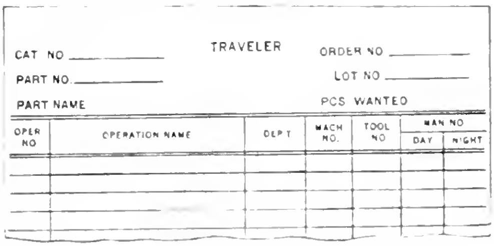


Fig. 7. FORM FOR "TRAVELER," OR JOB CARD WHICH MOVES WITH THE JOB

under the new methods our production increased to an average of 52376 units per month or 52.6 per cent. For

OPERATION CHECK SHEET

Year

Part Name

Catalog No. ______

Part No. ______

OPER No					OPER No					OPER No					OPER No .					OPER. No.					OPER No				
Date	Order Lot Number	Man No	Pcs Comp	Time Hrs	Date	Order Lot Number	Man No	Pcs Comp	Time Hrs	Date	Order Lot Number	Man No	Pcs Comp	Time Hrs	Date	Order Lot Number	Man No	Pcs Comp	Time Hrs	Date	Order Lot Number	Man No	Pcs Comp	Time Hrs	Date	Order Lot Number	Man No	Pcs Comp	Time Hrs

Fig. 8. FORM FOR OPERATION CHECK SHEET

the first nine months of 1920 it showed an average of 50851 units or an increase of 45.9 per cent. Then it began to fall off somewhat, due solely to the falling off in business that came at that time. One thing the production planning system did for us at the time of approaching depression was to give a sure guide in laying off employees without danger of laying off too few or too many.

The comparative production chart (Fig. 9) will better illustrate the results than any further description which I might add. It shows a falling off toward the end of 1920 when business was a little less active, yet we were still better off than our original average.

While our costs, conservatively speaking, were reduced some 20 per cent or more, we found that the earnings of our employees as a whole had increased some 20 per cent or more. This was possible since the pieceworkers were able to give their entire time to production and were never forced to idle because of lack of work ahead. There is always a smooth flow of work to them.

One of the important points in which we were vitally interested was the reduction in the value of Goods-in-Process account. We manufacture to finished stores and measure our shop turnover against these deliveries. That is, we watch the ratio between the value of goods in process and the deliveries to the finished stores department. For the few months before we changed our methods this ratio was 0.86 of a turnover per month which means that it took a few days more than a month to make one turnover.

Our continued efforts toward refinement and improvement of the production methods caused this ratio to rise to 1.11 turnover per month for 1921, which means that the reduction in the value of goods in process was about $84,000. Our continued efforts improved this still more so that for 1922 the turnover

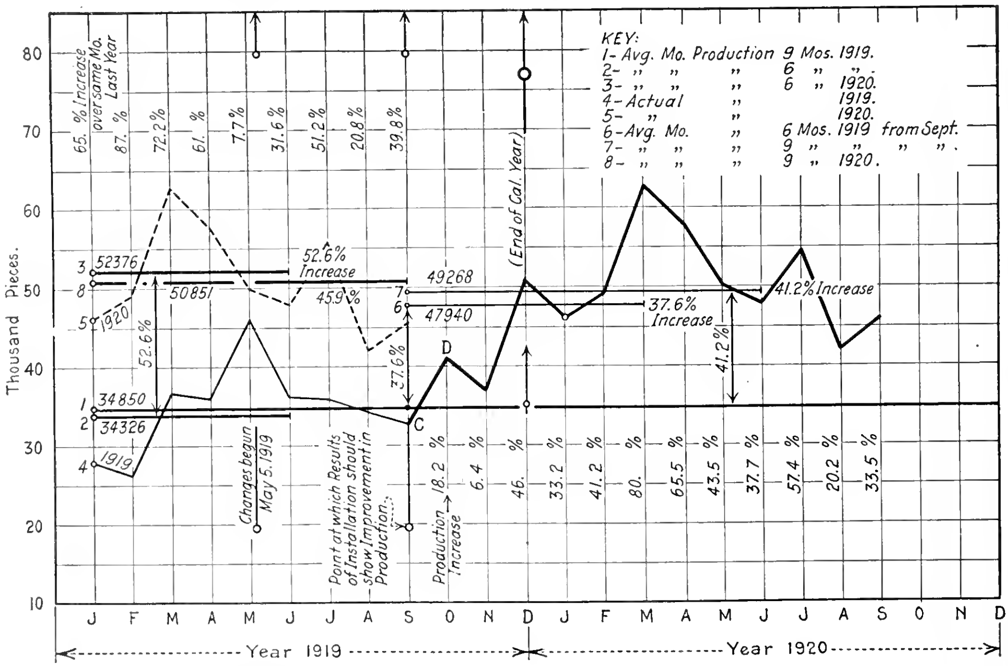


Fig. 9. COMPARATIVE PRODUCTION CHART FOR YEARS 1919 AND 1920

proved to be 1.31, or a reduction of $130,000, in the value of goods in process; which means that this amount of money has been released from our working capital for other purposes.

The reduction in our costs since the new methods were adopted has saved us more than $200,000. This does not, of course, include the additional profits which resulted from being able to handle larger sales with the increase in productive capacity.

The total cost for outside service and for all the physical changes we had to make amounted to a little less than $20,000.

How Shall We Select Our Executives?

By E. H. FISH

Class Number
658.415 Employment Methods
658.4121 Executives

EVERY organization that begins modestly and develops healthily stands in most serious danger of some day reaching the point where it outgrows the ability of the men who founded it. By that time it has undoubtedly been incorporated, and most probably the control of the stock has fallen into the hands of "outsiders," that is, other than resident working directors. Their problem becomes that of finding "hired men" who can carry on the work, earn dividends and, most of all, steer the ship off the rocks in times of business depression. The men who can do this are by no means certain to have any very great sums of money in their own names, nor is it always essential that they have a clientele of wealthy people who will furnish capital to firms with which they connect. As a matter of fact, capital wants to be shown, but is willing to be shown by total strangers as well as by intimate friends, for witness the many meteoric flights of some recent and coming business men.

The rewards which can be offered as salaries to successful men in large enterprises are far beyond what most of them have any intention of asking. A company doing a business of ten millions a year is not considered large and yet the difference between good management and better management may show a million dollars a year extra profits. Under such circumstances a hundred thousand for salary, to the right man, is only a trifle, but the risk of getting the wrong man is great, for the difference between good management and poor may easily exceed a million on the other side of the ledger.

The Present Method of Selecting Managers

The general manager insists that the shop hire its men through an employment department, hoping that some day a scientific method of picking lathe hands and machine operators will be found, but when it comes to selecting his own associates, or getting the job himself, he is very likely to look on it as a social process rather than a business one.

Selection of higher officials is very likely to be made by the acquaintanceship method. That is, each member of the board of directors writes, or talks, to as many people as possible regarding the needs, usually in a veiled way as if by chance some outsider might hear of the job, and out of all the recommendation from friends some one man is picked. Of course, there might be a dozen men across the street better qualified by nature, training, and experience for the job, but they have no means of knowing to whom to apply or even that an opening exists, and so they are never heard of.

Every organization really does want to get the best man possible, and it goes at the job in the manner stated above because it is the only way it knows. That being the case, it behooves every man who thinks himself capable of holding such a job, to secure the acquaintance of as many moneyed men as possible, or more especially the friends of moneyed men. This is one reason why so many banking men have gravitated toward responsible positions in the manufacturing field. From two points of view this is advantageous. On one side bankers are becoming better acquainted with the sources of the money they handle, and on the other, manufacturers are beginning to do their banking more as a matter of business and less as a matter of personal friendship.

It is an open question whether any man ought to be given large responsibilities who has had only the narrow experiences of one firm, or of one line of business. A man who has been in a woolen mill all his life may know woolens, he may know plant layout and he may know how to manage men, but transfer him to a candy factory and he has it all to learn over. Changes in one line of industry often come so slowly and gradually that one may wake up to find himself ten years behind a competitor, while by changing from one kind of manufacture to another one is constantly discovering new ways of looking at problems. Engineering graduates are handicapped in this way even more than other college men because they have to work at details so long after graduation that, by the time anyone is willing to give them responsibility, what was taught them of business administration has become entirely out of date.

Men Who Can Work Their Way to the Top

There are men who show executive ability so strongly that they make their way up through business, not by struggling but rather as bubbles rise to the top of liquid. These men have in the past been sufficient in numbers to give what has been thought an adequate supply of leadership. However, there must be many more men without that natural impulse who could work their way up. We are sure of this because here and there men not wonderfully bright have made their way by sheer persistence and by being on the spot at the right time.

For every one of these there must be ten who have as much ability but who lack the particular opportunity that has come to these others. Those who reject the idea that luck has anything to do with it should observe that thousands of men in an industry may never know when or where there is an opening for which they might be considered, because it is not publicly advertised.

Sources from Which to Recruit Executives

What are the sources from which executives might be recruited and how should they be brought along into the jobs which need them? The obvious sources are the schools, not so much for what they have given their pupils but because they have weeded out most of the men who have an insufficient grip on themselves to succeed. Again, the fact that a man has secured a degree at any good college practically guarantees that his intelligence is fairly high. Intelligence is not the whole of an executive's assets, but it is a large part. However, it should be borne in mind that the engineering graduates have been trained in an atmosphere of precision. They have been measuring things. A micrometer is to them a rough means of estimating the size of a shaft. They like better to figure in terms of wave lengths of light. Ordinary, hit-or-miss calculations do not appeal to them. And yet the manager of a business has to deal all the time with the human element which will not stay put long enough to be measured. The academic graduate, on the other hand, is weak where the technical man is strong. Mechanics, machinery, shop methods are Greek to him. He does generally know more about human nature, about how to get men to do things, and he has nothing to unlearn before he can learn more. But, all told, only about two per cent of men ever graduate from colleges of any kind. Some executives must continue to come from other sources, and the discovery and proper training of these men is of greater importance to industry than are all the college men put together.

The requisites for an executive are, broadly speaking, character, intelligence, and knowledge. A man of character, exhibited by loyalty and honesty, who has native intelligence, can always be taught if willing, the knowledge of any industry sufficient to enable him to be an executive. But there is something that distinguishes successful executives—an almost uncanny faculty for sensing the future. They seem to know when to buy materials, equipment and supplies, when to sell down to the last machine in the storehouse, although they cannot tell anyone how they do it. So long as they are right no one questions their skill, but one misinterpretation of facts bringing a loss to the firm results in a much lessened confidence from the Board of Directors. In recent times there has been much less tendency to depend on such one-man prognosis, and to make all moves subject to action of a committee or of the board itself; and a further tendency to rely on outside agencies to gather the data regarding the movement of markets and use that in place of this rather rare power.

Not every man who is intelligent and well informed desires to be an executive. A great many men have the constructive spirit, but find sufficient expression in designing machines or buildings for others to build. Directing the efforts of workmen or others has no great charm for them. There are others who prefer the financial side. Hence to these other qualifications for an executive there should be added the desire to manage men. This is by no means indicated exclusively by the mixing qualities which they may have shown in youth, nor is it indicated by their popularity. In fact, popularity may easily be gained by means which would, if carried into business, result in prompt bankruptcy.

A man may like to manage other men, and be successful at it, without being a mixer at all. It is not necessary to an understanding of men that one should be one of the crowd, he may gain as much by being an onlooker and giving sober consideration to the ways of the crowd. Being popular is a handicap to an executive in some ways because of the carrying of social obligations into business.

The leading business executives of the past and present have each possessed distinctive characteristics. Probably each one of them would lay his success to qualities quite different from those credited by the others. But, after all, when these reasons are analyzed, character, intelligence, knowledge, and an impulse to manage the work of other men will be discovered as a fundamental in each case. Whether the man was fully gifted with the embryos of these qualities at birth, or whether they were developed from experiences in his early life and throughout his business training, is immaterial, except, perhaps, that the naturally gifted man will arrive at a position of responsibility quicker than one who has to develop the qualities that insure his success. Moreover, while achievement depends on the necessary opportunity, these basic qualities hold a man to the sticking point and enable him to see and grasp the chance when it comes.

Criterions for Executive Material

What, then, are the criterions for determining the material from which an executive may be made? First of all, a reasonable amount of intelligence, which may be measured, perhaps not so accurately as some think, but certainly measured. A man of low mentality may go quite a long way in management before his lack stops him, but if a firm wants a man to go all the way through to the general managership, it must see that the candidate shows high mentality at the start. Then, second, the man must have a good supply of common sense to deal with his fellow men. A course in psychology may ruin a man of small common sense, but if a man's native appreciation of the value of his associates is good, he can study psychology without injury to himself. Given these things he may safely be loaded up with facts regarding the business and its relations to other business, to government, to markets and so on, as long as there is anything of value left to learn. Now, given good health and a strong constitution so that he can stand the physical strain, and a strong set of nerves so that he can go through disheartening experiences without losing his grip, we have a man who should become an executive, and we have selected in a much safer way than by the social method so much in vogue at present.

Practical Methods for Planning Work

IV—Repairing Locomotives and Freight Cars in Quantities

By WILLIAM B. FERGUSON
Consulting Engineer

Class Number
658.51 Planning
658.9:625.2 Railroad Equipment Management

REPAIRS to the rolling stock of railroads are in a class between the single or non-repeat jobs, such as reconditioning the "Leviathan,"[1] or building the Madison Square Garden Swimming pool,[2] and the repeat or contract jobs, like the filling of an order for 1500 steel freight cars of 57½ tons capacity, to be later described. In overhauling locomotives and freight cars there are several operations of the same kind to be performed, but not large enough quantities to justify much special equipment or expensive planning methods. We will, however, lay stress upon several basic planning principles which apply to all manner of production.

FIG. 33. REBUILDING CONSOLIDATION ENGINES IN LOCOMOTIVE REPAIR SHOP

Before we start planning in detail, we should set down what the final operations are to be, and thence work back to our starting point. Our plan should be not only complete and rational, but practicable and flexible. By flexible I mean that we should not set a lot of "schedule dates" that we would like to meet, and, by issuing orders to our subordinates to meet those dates, think we are planning. This is not planning—it is trying to force our subordinates to plan—and such a scheme, purely arbitrary and unsound, usually results in our subordinates getting disgusted and nothing is accomplished except a lot of paper work and expense.

As we get into the machinery or mechanisms of planning, whether manufacturing or repair work or construction work, we soon discover that no *one* phase of the subject can succeed unless *every* phase is controlled by some one who is competent, and unless all phases are co-ordinated by some one who knows a great deal about all the phases and factors. These factors, or subjects, are forever with us, in any kind of production, namely:

1. Design of the product—whether manufacturing, construction, or repairs.
2. Design and location of the equipment and facilities for making the product.
3. The organization and personnel: Assigning functions or duties to men fitted for the particular functions.
4. The sequences of operations, and the interdependence of operations. Job-analysis is one element of this.
5. The flow of materials and how to keep work ahead of operator. Routing and dispatching are included here.
6. The methods or processes of doing work, and, where possible, the "one best way," which Gilbreth emphasizes.
7. The determination of standard times—or how long it should take a man or gang to do so many units of work.
8. The setting of times or rates of pay in the form of an incentive system.
9. The human element, or how to get other men to co-operate or work with you.
10. Good inspection of work. Technical knowledge and thoroughness are required.
11. Counting work, accounting, and cost keeping. These measure the results.
12. The use of comparisons of results in such a way as to keep everyone interested. Judicious publicity of cost and production records, always by comparison with some "standard."

These twelve subjects are important in any kind of production, but particularly so in repair work, such as

[1] See *Management Engineering*, May 1923, p. 293, and June 1923, p. 369.
[2] See MANAGEMENT AND ADMINISTRATION, July 1923, p. 33.

repairing locomotives or freight cars. If any one of the twelve is neglected, the work will take longer and cost more.

Whatever the work—locomotives, freight cars, or sewing machines—the first thing to do is, of course, to find out what materials are to be renewed or replaced. This requires a most careful detailed inspection and checking, item by item, and piece by piece. Only a

NEWPORT NEWS SHIPBUILDING AND DRY DOCK CO.

WORK TO BE DONE ON............ENGINES

Sheet 2 of 17 Sheets

Name of Part	Engine No.					
	Strip	Inspect	Cleaned	Work Done	Erect	Test
Fittings—Cab and Boiler						
Steam turret......						
Cab valves........						
Injector check valves						
Blow-off valve and rigging						
Water gage and valves ..						
Whistle and rigging....						
Safety valves						
Lubricator...						
Inspirators and pipes..						
Steam and air gages..						
Oil can stand						
Blower valves..						
Steam heat arrangement ..						
Fire door and details......						

FIG. 34. PORTION OF CHECKING LIST FOR REMOVAL AND REPAIR OF LOCOMOTIVE PARTS

Five items on domes, 6 on throttle and 4 on superheater appear also on this sheet, but are omitted here to save space.

partial or preliminary inspection is possible before the locomotive or car is stripped or partially dismantled, after which the final inspection and preparation of complete specifications and bills of material can be made. Fig. 33 shows a group of locomotives stripped for rebuilding.

An organized, systematic, and orderly checking of parts to be removed, renewed, or repaired, on a standard form or checking list, is very essential. Such a form is shown in Fig. 34 (in part) for a locomotive, and in Fig. 40 for a freight car. The locomotive is a Mallet type and the freight car is a 50-ton steel coal car, hopper type. Some idea of the many small parts to be taken care of on a locomotive may be obtained from the view of the cab, Fig. 35, and from the fact that 17 sheets are required for an inspection report. A "Graphic Report of Progress" of work on overhauling a locomotive is shown in Fig. 36.

In the repair jobs selected for illustration, there has been an unusual opportunity to observe the improvement over the usual repair work methods, made possible by careful planning, for the following reasons:

Locomotive Repairs. There were three separate orders executed, the first for 2 locomotives, the second for 8, and the third for 15. The first job was not planned, but with the succeeding orders planning has been developed with positive proof of its value. Other examples of locomotive repairs on a large scale will be given to illustrate further the marked improvements in speed, economy, and meeting promised dates.

Freight Car Repairs. Two separate orders in succession, one for 50 cars and one for 100 cars, have shown that planning pays. Car repair work on a large scale by planning methods will be briefly described, to show how clearly convinced the more progressive shops are of the virtues of careful planning methods.

The Most Important Thing in Planning

Whenever we examine the detail records of an unplanned job of any complexity or magnitude, and see the record of each workman every day and hour during the entire progress of the job, what do we usually find to be the prime reason for delay or high labor costs? The answer is *materials.* The separate items of material were not ready for the workman when he needed them. It may have been only a few pieces missing, now and then, but my experience in every form and variety of unstandardized production or non-repeat work or parts manufacturing, leads me to state that over half the "waste" in time and dollars is due to lack of materials—first, when needed, and second, in quantities needed for continuity.

The next analysis nearly always shows that if the exact status of materials ordered or in process had been known, item by item, piece by piece, *before* the workmen started work, they should not or would not have been started at the time they were. The ordinary non-planning custom of starting men at work on a job

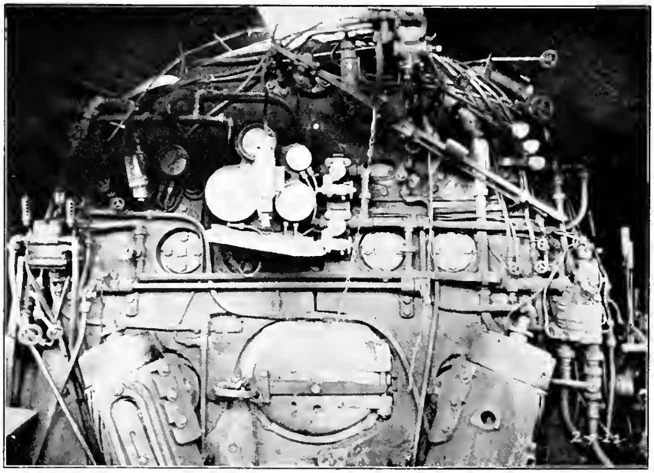


FIG. 35. INTERIOR OF CAB SHOWING THE VAST NUMBER OF SMALL PARTS TO BE INSPECTED

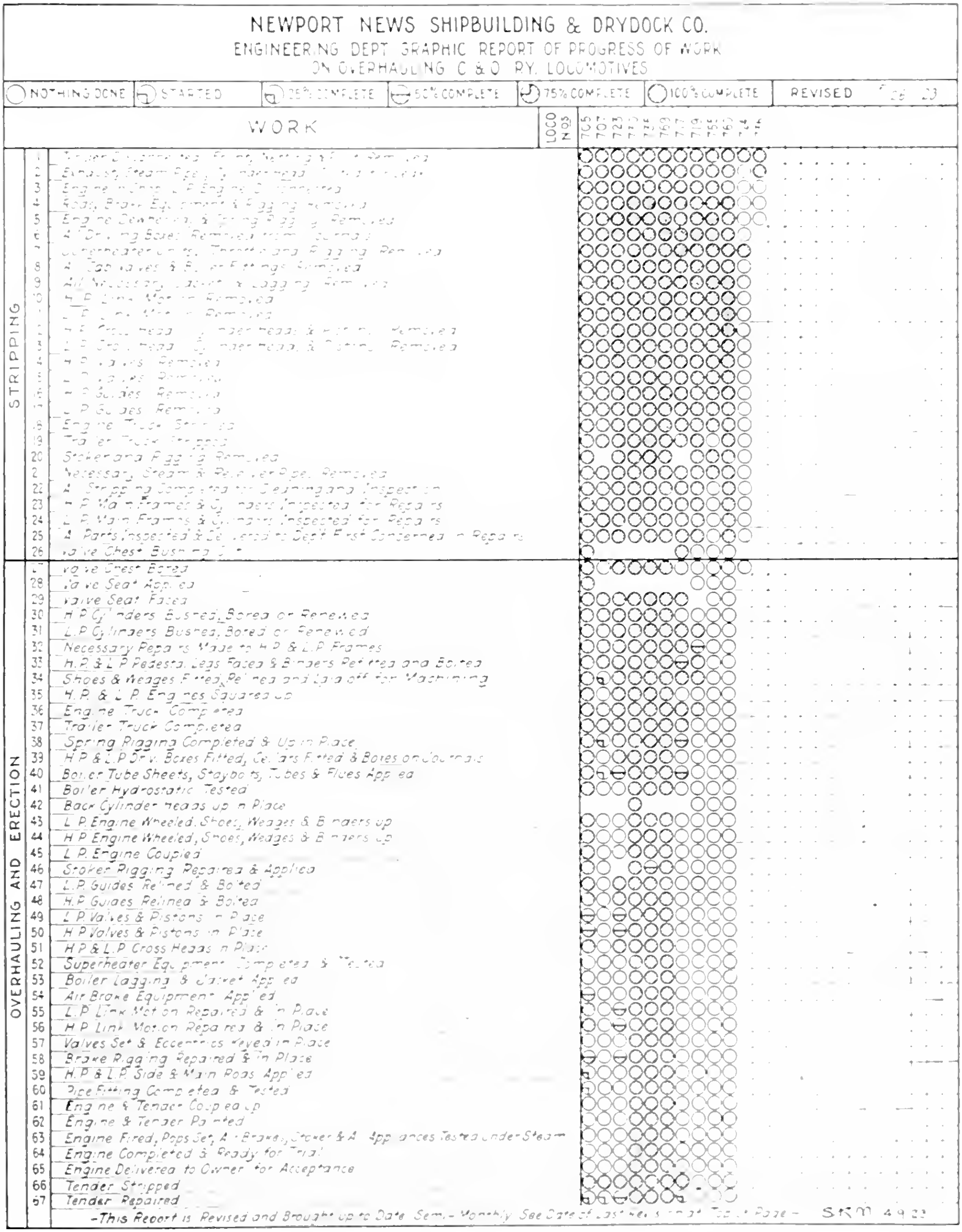


FIG. 36. GRAPHIC REPORT OF PROGRESS OF WORK ON OVERHAULING A LOCOMOTIVE

PRODUCTION DEPT. C P R ANGUS LOCO DEPT. SCHEDULE
DATE 19 . 18-DAY REPAIR SCHEDULE SCHEDULE NO

Days in Shop	Operation					
	Erecting Shop	Boiler and Tank Shop	East Machine Shop	West Machine Shop	Brass Shop	Steamfitters' Shop
1	Engine in Shop Engine off Wheels	Netting & Plates out				Strip Pipes for Test
2	Steam & Exhaust Pipes out General Stripping Completed	Hydro Test Ashpan Down				Start Removing Superheater Pipes
3	Headers Out All Material Cleaned and Delivered	Chip Tube Beads	Strip & Clean Wheels, Boxes, Crossheads & Pistons	Clean & Test Main & Side Rods & Deliver to Smith Shop		Superheater Pipes Out Complete Finish Stripping Pipes & Remove to Racks
4	Cylinder & Valve Bushes Inspected	Cut & Remove Tubes Complete		Strip & Clean Motion New Parts Ordered	All Brass Work Received & Stripped	
5	Old Cyl & Valve Bushes Cut out	Boiler Work Started				
6	Cylinders Patched					
7				Motion Pins to SS M & S Rods Received		
8	Cylinder & Valve Bushes Rebored	Tubes Welded	Bottom Splices Cylinder Bushes		Mountings O K	
9	Guard Stays Up Shoes & Wedges Laid off	Coppers Applied	New Shoes & Wedges Box Sizes, Widths O K Top Splices, Valve Bushes			Pump Repaired
10	Mountings in	Tubes in Boiler Work Completed	Crossheads	Guide Bars Dry Pipe		Pump Finished & Tested
11	Spring Gear Up Guides & X-Heads Lined	Boiler Tested	Wheels	Motion, Valves		Copper Pipes under Lagging
12	Engine Wheeled Headers in Motion Hung			Bell Stand		
13	Pump O K		Smoke Stack Base Smoke Stack Hood	Main Rods, Eccentric Rods	Inspirators	Superheater Pipes in Superh'r Tested
14	Valves Set, Steam & Exhaust Pipes in	Tank Repairs O K	Smoke Stack		Whistle & Gages Lubricator	Copper & Iron Pipe Work Started
15			Piston O K	Side Rods	All Brass Work O K	Tender Pipes O K
16	Brake Gear O K	Ash Pan Started	Eng Truck Idler Wheels			
17	Smoke Box Front on Side Rods on Engine Trucked	Ash Pan O K Netting & Plates O K				
18	Engine Finished Ready for Trial	Light Work Completed				Iron & Copper Pipe Work Completed

PRODUCTION DEPT C.P.R. ANGUS LOCO DEPT. SCHEDULE
DATE 19. 18-DAY REPAIR SCHEDULE SCHEDULE NO

Days in Shop	Operation					
	Tender Shop	Erecting Machine Shop	Blacksmith Shop	Jacket Shop	Electrical Shop	Paint Shop
1	Strip Asbestos Lagging for Test			Strip Firebox Complete for Test	Strip Hand Rail & Cab Wiring	
2				Strip Cylinder Casing & Jacket		
3						
4			Anneal M & S Rods	All Jacket W'k Cleaned		
5						
6			M & S Rods Delivered			M & S Rods Sand Blasted
7	Tender in Shop		Motion Pins Hardened			Cab Cleaned & Primed
8	Springs Delivered to Blacksmith Shop Wheels Del'd to Car Mach Shop	Guard Stays Delivered				Tender Cleaned & Primed
9						1st Coat of Black Engine Surfacer
10		Spring Gear Delivered, Shoes & Wedges Planed	Engine Springs Delivered			Putty & Knife Paint Inside of Cab
11	Wheels Received from Car Machine Shop		Tender Springs Delivered		Dynamo Repaired	Rub Tender & Cab with Pumice Stone & Water
12	Boiler Lagged Cylinder Lagged		Engine Truck Springs Delivered			Coat of Black Engine Finish Tender & Cab
13			Idler Truck Springs Deliver'd	Cylinder Jacket on Start Replacing Boiler Jacket		Letter, Number & Stripe Tender & Cab
14	Buffer Beam Coupler Pilot O K				Dynamo Delivered	1st Coat Varnish
15	Tender O. K	Brake Gear Delivered		Jacket Work Completed	Lamp Fixtures Made up	
16						2nd Coat Varnish
17					Wiring Finished Complete	
18	Tender Coupled up				Test & Inspect Dynamo, Wiring	All Paint Work Finished

FIG. 37. MASTER SCHEDULE FOR REPAIRING LOCOMOTIVES IN THE ANGUS SHOPS OF THE CANADIAN PACIFIC RAILWAY

or operation, and *afterwards* discovering at some time that they are short of material, is so prevalent in repair work, in construction work, and in manufacturing, that we may well believe that "lack of material control" is the crying evil of inefficient production.

It is useless to attempt sticking to a logical or predetermined sequence of operations without a real material control system. In fabricating or manufacturing processes, such as punching, drilling, shearing, boring, milling, etc., a good practice is to adopt an arbitrary rule not to allow a mechanic to start on a batch of material unless there is at least half a day's work piled up in front of his machine. The same principle should be used in all operations, and this applies to repair work as well. The difference from manufacturing is one of degree or kind only, that is to say, in repair work the "work-ahead" of an operator or gang may not be all of the same *kind*. In fact, it seldom is, but whatever kind of work or whatever variety of materials or operations are to occupy the operator for the next half day or day or week all the material he will use or work upon for the arbitrary period decided upon should be in front of his nose before you let him start work on that particular job.

Any waiting time between jobs, which could have been eliminated by planning well ahead, should be recorded as "waiting time," and the true reason given. We should not knowingly let this idle time be charged to "operating time." It should be charged against the management.

When the specifications and complete bill of materials required have been prepared, and the dismantling or stripping has been done, then comes a careful job analysis, operation by operation, arranged in logical groups and in dependent sequence. The time and man-hours required for each operation are then deter-

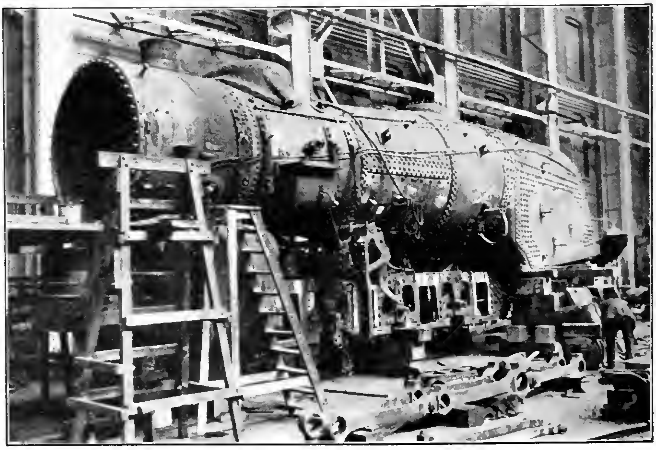


FIG. 38. MALLET TYPE LOCOMOTIVE BOILER STRIPPED FOR REPAIRS

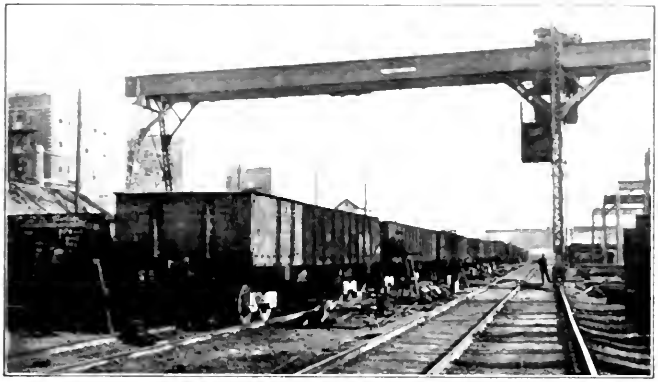


FIG. 39. COAL CARS AFTER FIRST CHECK OR INSPECTION

mined, as in any class of work, by analysis of similar or identical jobs, time-studies, comparisons, etc., and we are then in a position to make out a feasible time-table or schedule, numbering the days as 1, 2, 3, etc., but not giving scheduled dates yet, such as July 2, 3, etc. Not yet! This is the point at which to stop and think what you are doing. For, supposing the materials for operation No. 1 do not all arrive by July 2, then you at once get into trouble. Your brains and experience tell you that you ought not to start July 2, but your so-called "schedule" tells you to start. Then what do you do? You either start, which is *wrong*, or you change your scheduled dates, which is also *wrong*, and which takes a lot of clerical work, causes confusion, and damns the so-called "planning." Planning is not to blame, but "time-scheduling" is.

Therefore, at this point, do not call day No. 1 the date of July 2. Let it remain unnamed until the materials needed for day No. 1 actually arrive at the nose of the mechanic. If that day falls on July 2, well and good. Then name day No. 1 as July 2. But if the materials for that particular operation arrive on July 23, then on July 23 name day No. 1 as July 23, provided the subsequent "flow" of later materials is assured. Do not just *hope* the rest will come steadily. If the exact situation indicates a probable "gap" or delay in material flow of 5 days, later on, you had better not start on the first operation until 5 days after July 23, or July 28, which then becomes day No. 1, in your time-table.

More "waste" in time and dollars comes from violating the above principles by "starting before ready for continuity" than from any other single cause that I know. The time of *starting* a job or race is not the important thing, but the time of *finishing* it is what counts. The early finish comes from the average *speed* in a long race, the rate of progress after starting and the distance to go are the important things. This point will later be brought out more clearly by diagram.

The above comments on material control bring us to the planning of actual production, beginning with the first operations. In a large locomotive repair plant, where a big stock of repair parts is kept, the material problems are simplified and work can start promptly after it is planned and scheduled. Fig. 37 shows such a master schedule for repairing locomotives in the Angus Shops of the Canadian Pacific Railway, located near Montreal.

With this master schedule as a base, weekly schedules are issued to each department showing what work is to be finished in that department on each locomotive undergoing repairs. These detail schedules show the gang number assigned to each operation. A steady stream of regular output is the result, which would be impossible without a regular plan. Every day the progress on each locomotive and each operation is checked by a schedule checker or progress man, and a

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY
FREIGHT CAR INSPECTION SHEET

C & O Series 21000-21999
" " 25500-25999
" " 50000-50499
" " 50500-51499
" " 52500-52999

Sheet 8 of 8 Sheets

1st Inspection 7-25-1922

Repairs to C & O 50-Ton Hopper Car No. 51471 2d Inspection 8-11-1922

RNA	NA	DESCRIPTION SIDE CONSTRUCTION	MARK	R	R&R	RSR	RIVETS CUT DRIVE	MISC	CHECK	MATERIAL
		Side top angle	BS-11					2 Str.		
		Side top angle reinforcing								
		End side sheet	BS-4					1 Str.		
		Int. side sheet	BS-3					1 Str.		
		Center side sheet	BS-3A					1 Str		
1		Side sheet splice pit (6'-5")...	BS-6				104 104			
2		Side sheet splice pat (4'-11"-R)	BS-7				38 38			
2		Side sheet splice pat (4'-11"-L	BS-7A				38 38			
		Side stake (3-5)	BS-2			1				
		Side stake (4).	BS-2A							
		Side stake (6)	BS-2B							
		Side stake (2)	BS-2C					1 Str		
		Side stake (7)	BS-2D							
		Side stake (1)	BS-2E					1 Str		
		Bottom side angle	BS-12							

FIG. 40. PORTION OF A CHECKING LIST FOR STRIPPING AND REPAIR OF COAL CARS

Seventeen other items appear on this sheet, but are omitted here to save space.
Key to symbols: R, Remove piece from car; R & R, Remove and replace, no repairs; RSR, Remove, straighten and replace; NA, new piece, apply or install; RNA, Remove old material, apply new piece; Str., Straighten.

daily sheet of "explanations" made out for the management.

A *daily schedule* is made out at the Angus Shops for the boiler and tank shop, with a column for locomotive numbers, one for descriptions of the work to be done, and one for "explanations" if any operation is late or behind schedule. An idea of the work involved on a locomotive boiler is given by Fig. 38.

Comparing the results from a locomotive repair job which was not planned but done in the customary jobbing fashion, with the possible savings on planned work, I will quote from a report by the engineer in

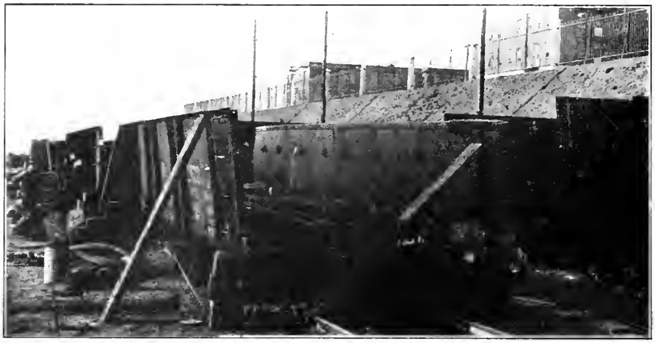


FIG. 41. FIFTY-TON COAL CARS STRIPPED AND READY FOR SECOND CHECK

charge of estimates at the plant where the first lot of 2 locomotives, mentioned above, was done. He says that "the lost time on previous work was due to:

1. Delay in getting equipment and material.
2. Improper tools.
3. Misinformation and lack of information.
4. Improper and poor routing of work through the shops.
5. Improper order of erection and stripping.
6. Changing of inspectors.
7. Distribution of work in shops.
8. Employing too expensive men on certain operations.
9. Unnecessary work done.

"In bidding on the new contract, the above was estimated at 10 to 20 per cent lost time, and a further reduction of 25 per cent was allowed for careful planning and scheduling."

On the next order there was improvement, and on later orders, where work was better planned, there was a further reduction of about 50 per cent in labor costs.

The stripping down of cars (see Fig. 39) is usually done by a specialist gang of strippers or car knockers, under an assistant foreman. Fig. 40 shows a portion of a checking list, and Fig. 41 gives a view of cars ready for a second inspection. It is important for economy to group or classify all cars of the same design or model, at every stage of the work—stripping, parts fabrication, assembling, etc. This permits piece-work or contract work to be handled more effectively. Whether the "progressive system" of car repairs is used, as in car building, or whether the cars remain stationary until finished, it is better to have specialist gangs do special work, such as underframe work, air brakes work, painting, etc.

As in locomotive repairs or any other production work, the material control is the beginning and the foundation of any economical planning or speedy production. There is no gain in time to be obtained by starting to erect material on a car undergoing repairs, any more than there is on building a new car, before all the material for the complete car is ready because the total time of erecting or assembling is only a few hours.

A list of operations in sequence is made up, with the assignments of men to each operation indicated, and the estimated or allowed time for each. A reasonable task is set for each gang, and if correct planning principles are used, every operation can be performed by piece-work or on a subcontract, which usually doubles the output over a day-work system, and frequently trebles the output. Practically the same operations and the same sequences are used in car repairs as in car building, except that some parts removed from cars can sometimes be straightened or repaired and put back again.

In railroad equipment upkeep—repairs to locomotives and freight cars particularly—we have one of our largest industries; and the more economical methods in use by the best shops, if used by all railroad and private shops, would result in enormous savings to the railroads. The opportunity is undoubtedly afforded for great economy, provided fair standards of performance are determined and piece-work and subcontracts universally used. More economical work, that is, fewer man-hours per locomotive and car repaired, means speedier repairs, for there is a limited and small number of men who can work on the same locomotive or car at one time.

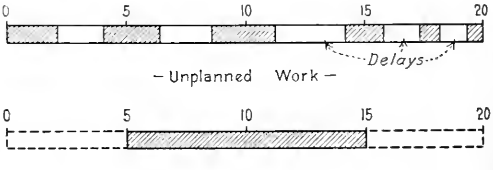


FIG. 42. TYPICAL SCHEDULES SHOWING CONTRAST BETWEEN PLANNED AND UNPLANNED WORK

Further savings are possible by standardization of the design of parts. The repairing of 100 cars of 5 different designs, which is not unusual to see going on, costs about twice as much in labor as repairing 100 cars of one design, all cars being of the same capacity.

In Fig. 42 the upper line illustrates the non-planning way of doing work—starting a job before it is ready and finishing it in 20 days. The lower line shows the planning way—not starting the job until everything is ready, the fifth day, and then finishing it in 10 days, or on the fifteenth day, for one-half the labor cost.

(To be continued in the September issue)

How the Walworth Company Looks Ahead

III—Anticipating the Customers' Seasonal Demands

By JOSEPH H. BARBER

Staff Assistant to Vice President, Walworth Manufacturing Company

Class Number
658.8(01) Sales Analysis
338.97 Forecasting Production

WHEN production is for stock in advance of sale, either the sales department is burdened with the attempted sale of all the goods which the factory may conveniently produce, or the factory is restricted to the production of the goods for which there is an anticipated market. True, the former policy is acceptable where a few specialized, suitably trade-marked, and distinctive products comprise the full, manufactured line. It is not an acceptable policy where a multitudinous product, staple in nature yet carefully trade-marked, must nevertheless move into a highly competitive market, where "a casting is a casting."

While the policy of unrestricted production is not acceptable under such conditions, the policy, on the other hand, of producing only that which can be sold often proves a very elusive ideal. It is the variety itself, which first insists upon a pre-production schedule of detail quantities to be absorbed by the market after production, and then condemns the actual preparation of such schedules because of the detail, time, and expense involved. Nevertheless, and in spite of the 23,000 items offered through our catalogue, which customers may ask for at any time, we do plan our production in such a way that our inventories will carry in stock and in proper seasonal assortment only such material as our customers are likely to want.

Do you sell what you make or do you make what you sell? Mr. Barber says: "In our earlier days, our answer to this question would have been, 'We sell as much as we can of what we make.' But now we answer, 'We make what we know can be sold.'" And in this article he tells how his company determines with at least fair accuracy what can be sold and what must therefore be made.

General Procedure for Establishing Control

The viewpoint of the present discussion of seasonal demands will be that assumed by us as we approached this particular "case." Our determination, in research cases, is to consume time only in studies, the findings from which can be directly applied to our developing plan of control. Here, the study could prove such value, because the anticipated findings would be directly applicable to our "Quarterly Estimate of Sales Requirements upon the Works." The sole purpose was to provide a better statistical and historical background for this quarterly estimating.

To permit adequate presentation of our method of analysis in the space available here, we must assume that it is supplemented by the background material of the earlier articles of this series.

The annual estimate of sales involves establishment not only of dollar sales values by months for each sales unit, but also of tonnage volumes, by quarters, required for each of our two works. These tonnage volumes are established for each of the 9 major Walworth product groups.

This annual estimate is supplemented, during the year, by a quarterly estimate prepared one month in advance of each quarter. The estimates then made are extended to cover not only the 9 major group requirements, but also the further requirements of a subclassification of the major groups, called product classes. Thus, 9 major groups, composed of 18 minor classes, control the production of the 17,000 items of our own manufacture, carried in stock.

The quarterly combined requirements are passed on by the vice-president in charge of production, in separate allotments by groups and classes, to each of the two works for production arrangements. Each works in initial response sends the vice-president a "Present and Proposed Operations Report," covering the first month of the quarter and subdivided into the same 9 major groups, or 18 product classes. Similar monthly reports are submitted to the vice-president 10 days in advance of each of the other months completing the quarter. When these monthly reports are submitted, it is not yet too late to effect minor revisions in the rate of production for specific classes, if necessary at either of the works.

Completing the Cycle of Control

The cycle of control is completed when the vice-president's allotment by product classes is translated into control by items and by parts. Adjustment of the production rate by items or pieces, is accomplished by the usual adjustment of the quantity to order on each balance of stores card. But the adjustment must be in exact accord with the adopted program.

Therefore, on each balance of stores card, we establish a basic quantity to order. The basic rate of production for any class as a whole, then, is secured by totaling the basic rates for all items within the class. The rate represented by the vice-president's allotment, is referred at once against this basic class rate. If the allotment represents, say, a 50 per cent increase over the basic rate, then each balance of stores card quantity is set for operation at 50 per cent over its basic rate.

Our justification for such a procedure is a "rule of our business" discovered very early:

The marked ebb and flow of total volumes tends to be accompanied by fluctuations at the same time, in the same direction, and to the same extent in the volumes of particular items. Or, in other words, the seasonal, general trend, or other influences which tend to increase or decrease the total volume of a product class, or of a line of product items, tend to increase by a like percentage the volumes of each item of that class or line.[1]

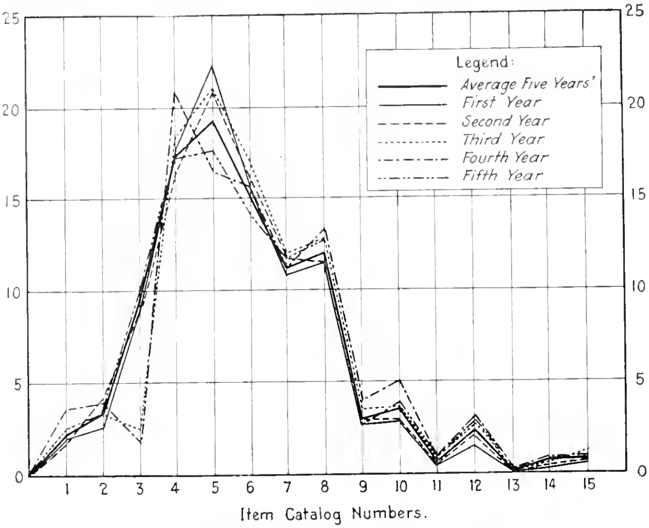


FIG. 6. PERCENTAGE RELATION OF SALES BY SIZES TO TOTAL SALES OF BLACK CAST IRON BANDED ELBOWS

Fig. 6 shows graphically how this rule operates to maintain over a period of five years of greatly varying volumes, a constant percentage relation to total of each item in a given line of product.

Thus are we enabled to apply in control the quarterly estimate which might otherwise represent only a desirable policy. For the submission of each monthly proposed operations report by the works signifies that the works has "broken down" the allotted class amounts to production rates for particular items.

Relation Between Major and Minor Product Demand

The quarterly requirements estimate calls for an estimated total tonnage volume by the major product groups and by minor product classes. However, by the nature of our product classification, we are able to analyze effectively our seasonal tendencies of minor product classes by analyzing the seasonal tendencies of our 9 major products only. This product classification, in its initial grouping sets up the "major product groups" according to the nature of the product. Secondarily, within the major product groups, a further grouping sets up minor product classes according to the form of the product.

For instance, our major product group, covering cast iron fittings in general, is comprised of a cast iron screwed fittings product class, a cast iron flanged fittings product class, and a miscellaneous cast iron fittings product class. Thus, within the major product group, the component product classes and product items are homogeneous in nature, and each item of the major group serves purposes very much like every other item in the same group. For this reason all items within that group respond to like seasonal demands. Similarly, all items in some other group, being within that group essentially alike in nature, respond in concert to a different set of seasonal demands.

Thus we arrive at a definitely limited field for research. This case analyzes the major seasonal variations in the demand, in terms of orders received, for the product of our 9 major groups.

Effect of General Trend on Group Sales

The general problem in the quarterly estimating of any particular group's future tonnage volume may be stated as follows:

Question 1. Will the future group volume be greater or less than its present volume—and how much?

Aside from secular trend influences (which are ignored in quarterly estimating), there are two influences which may cause the future tonnage to be more or less than the present tonnage.

1. The general trend (responding to the ups or downs of the general business cycle).
2. The seasonal variations from the general trend.

To direct more certainly our attention to separate study of the effects of each of the two influences, we therefore split question 1 in two parts:

Question 1 (*a*). How much will the future group volume be greater or less than its present volume, due to *general trend* influences?

Question 1 (*b*). How much will the future group volume be greater or less than its present volume, due to *seasonal* influences?

The answer to question 1 (*a*) was suggested by some of our earlier findings which gave the following:

[1] The rule stated above may be safely assumed to apply to all variations, except erratic tendencies, for all subdivisions of our product smaller than the product groups. This is not to say that there is no variation of particular items from the statistical average assumed to be followed in the application of the above rule. It does mean that where control of a multitude of product items necessitates establishment of routine procedures, the routine which we prescribe for breakdown of estimated totals has an established statistical average to operate in its favor.

Rule 1. All groups, in their volume fluctuations tend to follow the general fluctuations of the total of our own products. In other words, while demand for such products may go up or down, the ratio of group A to the total should remain fairly constant, the ratio of group B to the total should remain fairly constant, etc.

The operation of this "rule of the business" is shown diagrammatically by the chart of Fig. 7. The "Walworth Business Index" there shown, pictures the 1920-1921 declining level of dollar sales, corrected for seasonal variations. The "Index of all Groups" shows the nearly coincident decline of orders received, total similarly corrected for seasonal variations. The chart shows that, in its business cycle fluctuations, each product group index line does rise and fall at practically the same time and in the same percentage as the index line for total groups.

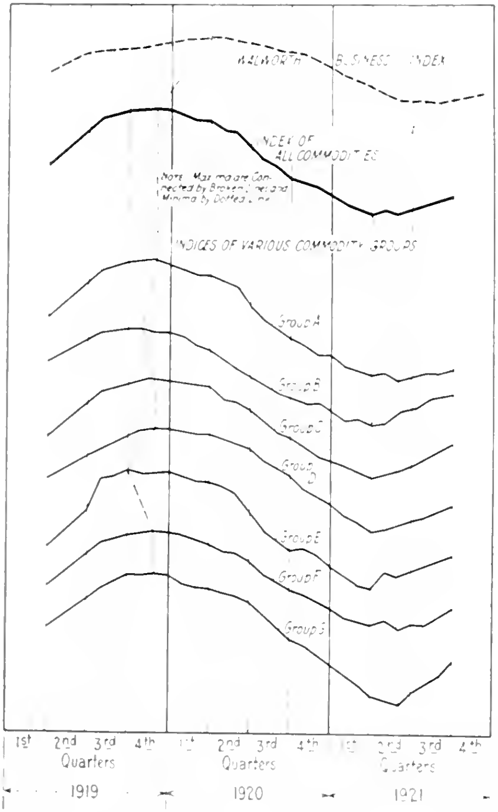


FIG. 7. COMPARISON OF THE "WALWORTH BUSINESS INDEX" WITH THE "INDEX OF ALL GROUPS"

This principle is the necessary connecting link between our earlier case and our present case. It follows that the forecast which we are enabled to make concerning the probable action of total volume, corrected for seasonal tendencies, is applicable in general to individual product groups after this has been corrected for seasonal tendencies.

The definite answer to question 1 (a) is then stated in the following:

Rule 2. *General trend* influences cause product group volumes to increase or decrease in the same percentage that they cause the total volume to increase or decrease.

The Relative Importance Ratio

The answer to question 1 (b) is not so readily stated. The full answer must be developed, or built up, and will consist of a sequence of rules, with suggestions as to their use. The first step in the building up process is the selection of the method to be employed for revealing the past seasonal tendencies of product groups.

By either of two methods general trend influences may be eliminated from product group volumes in order to reveal the group seasonal variations. Each individual group volume might be analyzed over a period of years:

1. With reference to the general (business cycle) trend for that group only, thereafter securing an average seasonal deviation, or variation, from that group's own general trend line.
2. As a proportionate part of a total always composed of the same combination of groups.

Statistics for a sufficient period are not available for employing the better method 1. Therefore, we proceed to analyze the group seasonal variations by analyzing the month by month variations in each group's ratio to total, method 2. We resort to study of these group ratios, however, only because, under conditions like ours, the month by month variations in the ratios will reveal (where other methods will not reveal) the group tonnage variations which are purely seasonal.

We call the ratio representing each group's proportionate part of total groups, a "Relative Importance" ratio. Thus, the "relative importance" ratio of group A in any period (month, quarter, or year) is the percentage ratio of group A in that period to the total in that period. For the four years, 1919 to 1922, these relative importance ratios for each individual group were tabulated, and the four January ratios were averaged, the four February ratios were averaged, the four March ratios were averaged and this same thing was done for each month of the year. Similarly, the quarter-yearly ratios and the annual ratios were averaged on the four-year basis.

Earlier experience in our business has led us to be wary of accepting averages for application to particular cases. So often have we found that an average of many

[2] The rules, which are to be stated here, are not, of course, infallible, nor do they possess mathematical precision. However, we find they do possess essential accuracy as principles for guidance when planning for the future.

[3] The use of method 2 develops some statistical error. The error in our case proves slight. The defects in the method are recognized, but the findings applied to estimating are valuable in spite of the defects in method.

months (or years) is not at all like any particular month (or year), that we made a special analysis of each of these four-year averages. We listed the columns, from original plottings on ratio paper, the seasonal variations in each of the four years, for comparison with the variations in the supposedly representative average year.

Fig. 8 and its accompanying table, show, for one group only, an analysis made from the viewpoint of establishing the essentially representative character of the average. The particular comparative tests were determined by the manner in which the average would be used when applied to future estimating. For each of the 9 product groups the average did prove essentially representative of each of the years that had been averaged, and the majority of the exceptions that were found to exist occurred in the two earlier years of 1919 and 1920.

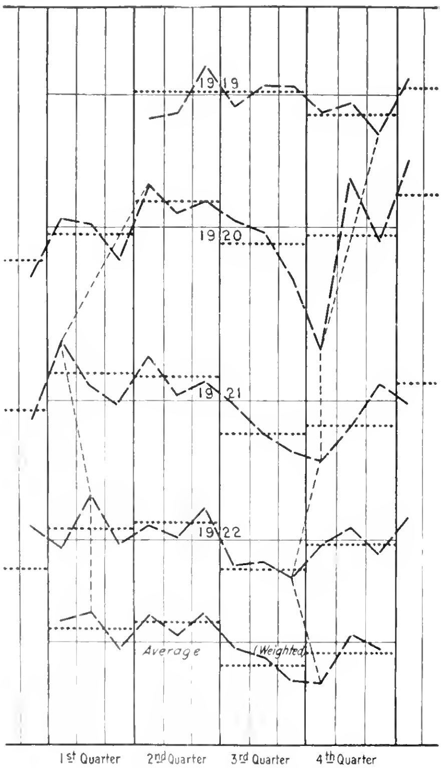
The test indicated that, from the standpoint of the *direction* of seasonal variation, in only four out of 100 cases would the average have led us astray. The test did not cover the *extent* of seasonal variation. The violence of seasonal fluctuation does vary according to particular times in the business cycle. If the high point falls at a time when optimism is running high, that high point will be marked a "peak;" contrariwise, the low points, falling at a time when demand is stagnant, will probably drop unusually low. Thus, the averages applied to estimating, as later described, provide an "average estimate," correct as to direction of the indicated variation, but, as to its extent, subject to some little revision in the light of present knowledge. This was not unexpected.

TABLE 1. GROUP G—SEASONAL VARIATIONS OF MONTHLY AND QUARTERLY "RELATIVE IMPORTANCE" RATIOS

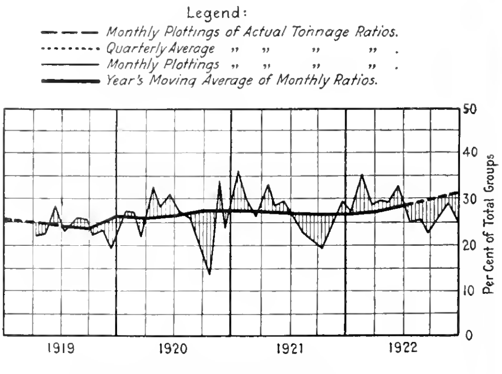
Analysis (From Fig. 8) of Characteristics Peculiar to Each Quarter of the Year

QUARTER AND MONTH	CHARACTERISTICS AS REPRESENTED BY 4-YEAR AVERAGE	NO OF CASES	EXCEPTIONAL YEAR NOT PROPERLY REPRESENTED BY AVERAGE
Total Number of Comparisons Made and of Exceptional Cases	....	49	7
1st Quarter Seasonal Characteristics			
Quarter's average compared with 2d previous quarter's average	Higher	3	None
Quarter's average compared with next previous quarter's average	Higher	3	None
High or low point within the quarter: *High*	In February	3	1920—In April
General trend of monthly ratios through the quarter	Downward	3	1922—Horizontal
2d Quarter Seasonal Characteristics			
Quarter's average compared with 2d previous quarter's average	Higher	3	None
Quarter's average compared with next previous quarter's average	Equal to	3	1920—Higher
High or low point within the quarter: None	....	0	....
General trend of monthly ratios through the quarter	Horizontal	4	None
3d Quarter Seasonal Characteristics			
Quarter's average compared with 2d previous quarter's average	Lower	3	None
Quarter's average compared with next previous quarter's average	Lower	4	1919—Equal to
High or low point within the quarter: None	....	0	....
General trend of monthly ratios through the quarter	Downward	4	None
4th Quarter Seasonal Characteristics			
Quarter's average compared with 2d previous quarter's average	Lower	4	None
Quarter's average compared with next previous quarter's average	Higher	4	1919—Lower
High or low point within the quarter: *Low*	In October	4	1919—In December
General trend of monthly ratios through the quarter	Upward	4	1919—Horizontal

Comment: It ia to be noted that of the 7 exceptional cases, the single case occurring in the years 1921 and 1922 is but aemi-contrary.



RATIO PLOTTING OF SINGLE AND OF AVERAGE YEARS



ARITHMETIC PLOTTING OF GENERAL TREND

FIG. 8. SEASONAL VARIATION OF "RELATIVE IMPORTANCE" RATIOS (GROUP G)

To visualize their differing seasonal variations, the group averages are brought together in Fig. 9, and we are now able to state the following rule:

Rule 3. The ratio of any group to total at any time within the year varies from the average for the year, but the variations are seasonally consistent, occurring in the seasons and to average degree shown in Fig. 9.

The application of this rule necessitates, of course, an original estimate of the total order volume for the coming quarter. By methods already outlined in the earlier articles we do arrive at such an estimate of total quarterly demand. By selecting the proper quarter's relative importance ratios totaling 100 per cent for the 9 groups this estimated total is readily broken down to product group amounts. The resulting group tonnages are then compared with group tonnages in the same recent months of the current year. Tonnages are adjusted if they appear unusual in the light of such comparison, or in the light of probable emphasis of high and low points.

However, though product group amounts for the quarter may thus be derived, we have not a direct answer to question 1 (*b*)—"How much will each future group volume be greater or less than its present volume, *due to seasonable influences?*"

A more direct answer can be made if we but assume—for practical estimating purposes—that the charted fluctuations represent equally as well the seasonal fluctuations of the actual group tonnages. To be qualified in practice by rule 5, this rule 4[4] may be stated:

Rule 4. Between any two seasonal periods, the seasonal change in the level of any group tonnage is in the same percentage as the seasonal change in the level of that group's relative importance ratio.

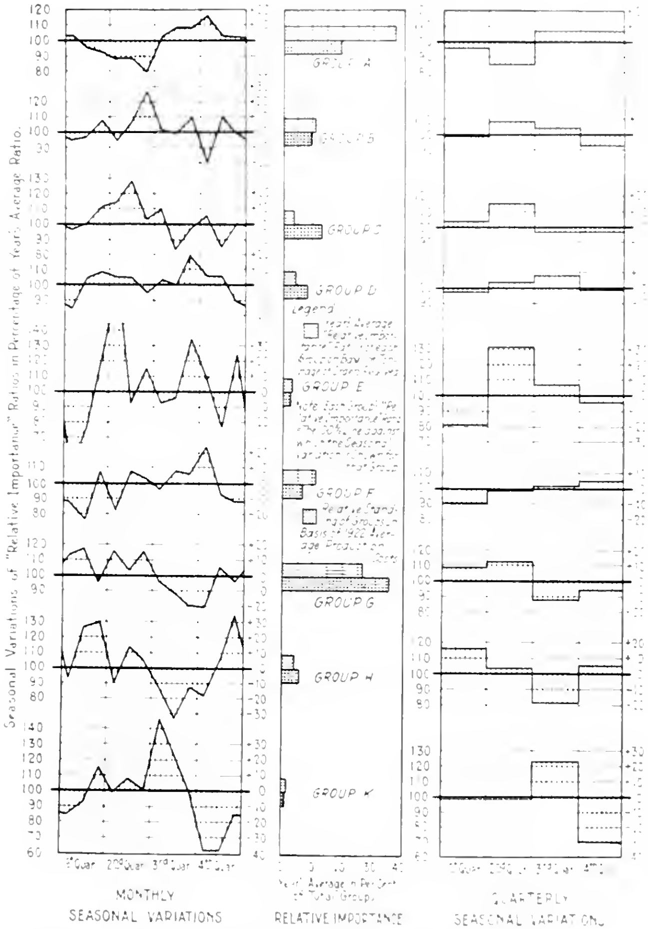


FIG. 9. SEASONAL VARIATIONS OF "RELATIVE IMPORTANCE" RATIOS
Based on tonnage of gross orders received, and showing weighted average of 1919-1922. The monthly and quarterly ratios shown are a quarterly weighted average of similar ratios for individual years. These ratios are plotted in percentage of year's average ratio based on a quarterly weighted average of yearly tonnages for 1919-1922.

Thus question 1 (*b*) is answered by rule 4, for, as Fig. 4 suggests, percentage changes in group tonnage levels caused by seasonal influences may be readily figured from the data on which the chart is based.

We have now all but completed a definite answer to the original question 1. By rule 2, we provided a basis for definitely estimating the effect of general trend influences upon group tonnages. By rule 4, we provide a basis for as definitely estimating the effect of seasonal influences. But, between the two, there is a relation which must be recognized in recording the final answer. Neither the one influence, nor the other, ever works independently. It was for convenience of analysis only that rule 2 (general trend variation) was stated as if there were no seasonal variation. Likewise, rule 4 (seasonal variation) is stated on the assumption of no variation caused by general trend changes—in other words, on the assumption that the general trend line is horizontal, as shown in Fig. 9. But, in practice, the general trend line is seldom horizontal. Instead,

[4] Theoretically, rule 4, cannot be advanced. It represents fact only if each group's trend line parallels exactly the actual monthly line of total groups, as well as the trend line of total groups. In other words, it represents fact only if there were no purely seasonal variation in the total groups' monthly line—which there is. Therefore, as a picture of past seasonal variations in group tonnages, the curves show some error. Nevertheless, "for practical estimating purposes," as stated, rule 5 may be used. The error introduced by such use of the ratios is "seasonal" and will be "corrected out" when applied in estimating the like season of a later year.

it is either trending up or down. Therefore, it is necessary to add:

> *Rule* 5. When estimating the group tonnage for a coming period, by decreasing (or increasing) the tonnage of a past period, to account for seasonal influences (See rule 4), the past group tonnage must first be corrected up to (or down to) the anticipated general business cycle level for the coming period. (See rule 2.)

Thus does our analysis lead to an answer to the original question 1, by answering first its two subdivisions and by binding together the two answers. There remains, then, only the necessity of providing a means for applying the findings to actual estimating.

Adjusting General Trend and Seasonal Variations

It may be said that the charts that have been shown here are but for clearly presenting the findings. In actual estimating, reference is made to the recorded tonnage figures, to the tabulated relative importance ratios, and to the calculated correction factors indicating the seasonal variations in level (rule 4) for all groups. And forms have been established to facilitate use of the data in practice. The rules, when applied, provide three distinct statistical estimates. Each of the three estimates results from a different projection of recent actual performance into the future on the assumption of a repetition of our known past business cycle and seasonal habits. They are as follows:

1. An estimate of group tonnage amounts for the coming quarter obtained by breaking down to group amounts (by the proper relative importance ratios for that quarter) the estimated total tonnage for that coming or estimated quarter.
2. An estimate of individual group tonnage amounts for the coming quarter, obtained by estimating forward from the fully known recent past quarter, which is the second quarter previous to the estimated quarter.
3. An estimate of individual group tonnage amounts for the coming quarter, obtained by estimating forward from the partially known uncompleted present quarter, which is the quarter next previous to the estimated quarter.

The first estimate utilizes rule 3 in the manner explained when that rule was stated. The second estimate utilizes: (a) rules 1, 4, and 5; and (b) the previously mentioned table of correction ratios for seasonal changes in group levels (as against the second previous quarter). The schedule form shown for this second estimate, carries its own explanation. The third estimate utilizes the same rules, a similar table of correction ratios (but as against the next previous quarter) and a like form of work sheet. In the case of this third estimate, however, the full tonnage rates for the present (the "next previous" quarter) must themselves be estimated for inserting in the "C" column of the form. But for this estimating of full quarter rates, there is at hand at the time of estimating, a knowledge of the actual rates throughout the greater part of the quarter.

The several estimates thus provided do not exactly agree, but this, in one sense, is an advantage. It is not presumed that any statistical estimate will be without error. If group C tonnage is unusually high in the second previous quarter, the coming quarter's estimate based thereon will also be high. But if group C tonnage is high in one quarter (the second previous to the estimate), it is likely to be offsettingly low in the following quarter (the next previous). Consequently, the coming quarter's tonnage estimate, based on that next previous quarter, will be low.

TABLE 2 SECOND STATISTICAL ESTIMATE OF — QUARTER, 192 , ORDER TONNAGES BY GROUPS BASED ON KNOWN TONNAGES OF ITS SECOND PREVIOUS QUARTER, OR — QUARTER, 192

Calculation 2(a)

To Find Correction Factor for Influence of Business Cycle Change Between Its Second Previous Quarter and the Estimated Quarter.

	(A)	(B)
(1)	Total Gross Orders (Wal. only) Second Previous Quarter ——192 (Tons)	
(2)	Total Gross Orders Estimated for Coming Quarter (Determined by other studies of business cycle)	
(3)	Correction Ratio or Factor to Account for Variation Caused by Business Cycle (a percentage ratio secured by dividing 2 by 1) *Note:* This ratio to be used as indicated in heading of column "D," below	

Calculation 2(b)

To Correct Known Tonnages of Second Previous Quarter to Higher or Lower Levels Expected in Estimated Quarter

	Group	Second Previous Quarter Tonnages: Tonnages as Reported (C)	Second Previous Quarter Tonnages: Corrected to Higher or Lower Levels (Col. C Amounts Times Above Ratio B-3) (D)
(1)	A		
(2)	B		
(3)	C		
(4)	D		
(5)	E		
(6)	F		
(7)	G		
(8)	H		
(9)	K		
(10)	Total		

Note: Total D-10 should check as the sum of the group amounts in column D and also with total B-2 of calculation 2(a).

Calculation 2(c)

To Estimate Group Tonnages for Estimated Quarter by Applying Group Seasonal Correction Ratios [Cols. D of tables 7(a) to 7(d)].

	Group Seasonal Ratios from Tables 7 (D Col's.) for Quarter of Year Corresponding to Quarter Now Estimated (E)	Estimate No. 1 of Tonnages for Coming Quarter (Col. D Amounts Times Col. E Ratios) (F)
(1)		
(2)		
(3)		
(4)		
(5)		
(6)		
(7)		
(8)		
(9)		
(10)		

Note: Total F-10 sums up F-1 to F-9. It will not agree exactly with total D-10 of calculation 2(b).

The Province of the Controller

II Specific Functions, Duties, and Relations

By JOHN B. GUERNSEY

Controller, The Emporium, San Francisco

THE controller's position in the modern business fabric has become fairly well defined within the last 10 years and it is possible to describe many of the duties of any controller as applicable to all controllers. The size of the organization and the nature of the industry have a direct effect upon the precise nature of the work that falls upon the controller, but his position in all organizations is practically the same.

Fundamentally the controller is the accounting and financial man. Possibly the first accountant was evolved from a bookkeeper, and the first controller from an accountant. It is more likely that the first controller was a good financial man and analyst who was incidentally a good accountant, and the combination was found to produce results that fitted in admirably with the requirements of business as it became more complex. Imagination and "un-satisfaction," if there be such a word, are necessary parts of the makeup of a controller, and he delves into the past only as a surveyor shoots back along the line he is running to get his bearings and check his computations.

Controllers cost money and no organization adds to its expense smilingly. But controllers save more than they cost, after an organization passes a certain point in its development. It costs more money to sell more goods or to turn out more products or to subdivide more acreage but that is no obstacle to getting the increased volume. The question of whether a controller is to be, or is not to be, passes beyond the realm of academic discussion as soon as a business organization reaches that point in its growth beyond which it is necessary for it to rely upon records and plans and analysis rather than upon the personal observation and instinctive direction of its general manager.

History Pays No Dividends

In a great many businesses, and large ones at that, the chief accountant and the entire accounting organization might as well be scrapped so far as their value to the business is concerned. This is the fault both of the management and of the accountant. Of what good are a lot of pretty statements and stereotyped reports of what happened back in the Dark Ages, when the manager operates by intuition and by the law of average guesses, and does not care what the reports show anyway? The average accountant lives in the past; and the relativity of the past makes little difference. Whether he is concerned with the Dark Ages or with last week, it is equally ancient history for all the good it will do his concern. The concern is living partly in the present but primarily in the future, if it is a successful and growing organization. What happened last week is of interest, yes! But last week is gone. The only thing of any value in last week's history is the effect on next week? Not at all; the effect also is an accomplished thing, dead and buried. The only thing of any value in last week's history is the corrective effect, or the confirmation, or the directing effect on your plans for next week and the weeks after.

The average manager will not and cannot abstract that quality from accounting reports and in that regard he has been outgrown by modern business. You have heard often of business concerns that have outgrown their managers. On the other hand you may have marveled at the ease with which a huge steel corporation or a railroad, or a big merchandising organization can manage the myriad, endless details of its operations smoothly and effectively. The difference lies in the difference in attitude of the management toward the whole subject of accounting, records, budgeting or planning, analyzing and decision.

In the one concern you will find a staff of underpaid, dissatisfied clerks headed by a half baked accountant who slinks into the majestic presence of the great "I am," with a poorly conceived mass of figures which

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Do you

1. Provide adequate check on the accuracy of cash figures?
2. Make sure that cash funds, as per books, are actually on hand?
3. See that such funds are guarded well by day, and are safe against fire and theft at night?
4. Provide ample burglary and hold-up insurance?
5. Arrange that only enough cash to meet the actual needs of business is kept on hand?

Do you know

1. Whether you should use one bank or several?
2. How dependable your bankers are, and why?
3. What balances you should carry in order to establish adequate lines of credit?
4. How surplus funds should be invested when normal bank balances are exceeded?
5. Whether you should receive interest on bank balances, and if so, at what rate?

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mean even less to the manager than they do to the accountant, and which receive corresponding consideration. If they confirm the manager's preconceived impression of what they should be, they are filed with a smile and could be destroyed tomorrow for all the manager would ever know or care. If they differ the manager knows that they are wrong anyway, so why should he concern himself to analyze them?

The Controller's Duties and Qualifications

In the office of the other class of business concerns, you will find perhaps equally underpaid and proverbially dissatisfied clerks, or occasionally a staff of perfectly contented and efficient workers, in either event headed by a keen accountant and his auditing staff; and somewhere in the offing you will find a controller who is keenly interested in the whole office. When an accounting report leaves that office it will be right to the last detail and every item on it will mean what it is labeled. But it will go to the controller, and not to the manager. When the controller gets through with it, its own mother would not know it except that it reacts to the same blood tests. It will be analyzed, dissected, condensed, and weighed, and finally combined with other material from numerous other sources to form a true picture of present and future conditions. There will be very little history in it, and that only as a background for forecasts or in substantiation of a change in plans. When that report reaches the management it will be studied, and marked up and criticized, and subjected to many tests. It will become the framework around which the management will build the operating plans of the business.

Because such information is vital in a growing organization, and because there is no other officer to produce it, a new major executive becomes necessary in the person of a controller. As pointed out in a preceding article,[1] the controller's duties may be divided into eight main heads as follows:

1. Protection of assets, in the interest of the stockholders or owners of the business, and, in the case of a corporation, the board's source of uncolored, emotionless information.
2. Operation of the controller's group of departments including accounting, statistical, auditing, credit, and accounts receivable, accounts payable, research and financial. He must have charge of these departments in order to make sure that the information on which he relies for his facts is absolutely accurate.
3. Devising and safeguarding of all accounting and other systems used in the entire organization, including cost accounting systems.
4. Statistical portrayal of the facts; analysis, comparison, and forecasting of trends.
5. Interpretation of the facts to others in the organization, including the managers of all operating departments.
6. Seeing to it that the organization conforms to local, state, and federal laws, including tax laws.
7. Research within and outside the business.
8. Budgeting of sales, stocks, expenses, and finances.

It was also pointed out that the controller must be an experienced accountant, with many years' actual accounting training behind him in as many varied lines as those with which the average senior staff man of a big accounting firm necessarily becomes familiar. Practical accounting must be second nature to him, but it is only his groundwork. Next to that must come more than a nodding acquaintance with finance, for in planning the financial program for a year ahead he must know how money is obtainable and make his plans accordingly, and must know what he is going to do with his temporary surplus funds and whether to let them earn interest or banking credit.

Many other specific qualities and qualifications of a controller were outlined, particularly applicable to the work of a department store with which the article was primarily concerned, but the same principles apply in any other industry. Knowledge of the industry and its economic status, of the particular business organization with which he is connected and of its competitors, are requisites. Also the controller must be able to inspire enthusiasm in his workers and respect in the eyes of the other executives with whom he works. To get the best results a controller must be insistent without being stubborn; a visualizer without being a visionary; a good trader when it comes to making concessions regarding variations from expense plans; and a man of agreeable personality without being a willy-nilly. A controller cannot please everyone but he can be agreeable. He can give and take on many points, but on others he must be insistent, particularly regarding adherence to budgeted plans. The best he can expect to do is to gain the respect of his associates and play no favorites. His position does not lend itself to glad-handing and palaver.

Protection of Assets

In describing what is meant by protection of assets as one of the controller's duties it is necessary to draw a sharp line, because as a matter of fact nearly every operation of everyone in an organization in some way can be considered the protection or exposure to destruction of some asset, including good-will of the public and esprit de corps of the concern as assets.

On the balance sheet are certain items set forth as assets and certain liabilities, the difference between which constitutes the supposed net worth of the ownership, be it a corporation, a partnership, or an entrepreneur. The controller should see to it that there is value behind each of the assets at least equal to the book value; that the risk of impairment in value is minimized by insurance or otherwise, or by the accumulation of adequate reserves; that any surplus in value is made known to the stockholders whether it is reflected in the balance sheet or not; that the book liabilities correctly reflect the accountability of the concern to others; that there are adequate reserves against all reasonable contingencies and that if there are risks not shown on the statements the stockholders know of them.

Cash assets require a certain type of protection that is quite uniform throughout the business field; yet full protection may be more far-reaching than is generally realized. First it is necessary to provide adequate checks on the accuracy of the cash figures; then to make sure that the cash funds called for by the books are at hand; that in handling them throughout the day

[1] *Administration*, June 1923.

they are not exposed to unnecessary risks, and that the vaults in which they repose at night are safe against fire and theft; that burglary and hold-up insurance is sufficient and in effect, and free from bothersome technicalities; and that only enough cash is carried on hand to meet the requirements of the business.

Funds in banks introduce other features requiring protection including the dependability of the banks; the question of whether they are the best banks to use considering their ability and willingness to meet the borrowing requirements of the business; what balances should be carried in order to earn the right to call upon the banks for funds; how such rights are determined and safeguarded, and whether one bank or a number of banks should be used; whether the banks should pay interest on average balances or not; what should be done with surplus funds when the proper bank balances have been exceeded, when to loan money on call and how, when to invest in short-term securities, commercial paper, and acceptances, and where to find such investments; what is a legitimate investment risk and what is not; and how best to protect bank deposits against loss through forgery and unwarranted withdrawals.

Cash is only one small item of the assets which it is the duty of the controller to protect in the interest of the stockholders or owners, and yet it is apparent that even this item raises a number of fine points of policy and judgment. The public accounting firm certifying to the statement is not required or expected to report upon these points of policy and judgment; the general manager has not the time nor should he be expected to study into them but only to pass upon the policies recommended; in many concerns the treasurer decides these points, but to that extent he acts as a controller; in the great majority of cases the secretary-treasurer is a corporate officer representing the interests of those whose money is invested, and the operating responsibilities of the position fall upon the controller.

The General Manager

It might be well to diverge here to point out the relation between the general manager and the controller. In a corporation where the general manager is employed by the directors to operate the company's properties there is always the possibility of a divergence of interest between the manager, the directors and the owners. The controller's position is necessarily of a dual nature, he being both an operating executive working with the manager and, as stated before, the directors' source of uncolored, emotionless information. In such a position the controller is a potential check upon the manager but there is no conflict of interest unless and until there is an attempt on the part of the manager to withhold information from the directors. Assuming that the controller has no axe to grind, the existence of friction between the manager and the controller is a pretty sure warning to the directors that the manager is seeking some personal gain or vindication at the expense of the corporation's interests.

Under a proper organization the general manager is the referee and moderator, who, taking his program from the directors or owners, sees to it that the desired policies are carried out throughout the organization, correlates the work of all the other executives toward a desired end, and is responsible for the development and safeguarding of buyer-confidence, good will of the public, and esprit de corps within the organization. He is or should be the "big chief" to whom the other executives look for guidance and inspiration, directing the various departments to the end that each will keep pace with the others, and passing final judgment upon the decisions and plans of the department heads. As the court of last resort, he should keep as far away as possible from the actual formation of the plans on which he passes judgment, so that at any time two or more executives may refer to him any disputed point in their daily work with confidence that his decision will be unbiased.

Materials and Stock

Except for the investment in plant, usually the next most important items in which the company's capital is invested, are materials or stock in trade and accounts receivable. Considering them in order, the former interests the controller as to its acquisition, its protection and valuation while on hand, and its disposition. He makes sure that it is bought against plans that have been duly considered by all departments of the business. He takes all possible cash discounts, even to the extent of paying bills before the material or merchandise is received if the conditions warrant. He is responsible for the sufficiency of checks upon count, quality, and agreement of the goods with the orders placed, and then for the distribution of charges, protection against loss, and completeness of the sales accounting machinery; and, in manufacturing, for the cost accounting system and methods.

In merchandising, the controller helps to plan, and then controls the purchasing limits or open-to-buy of the various selling departments. In doing so he is concerned chiefly with store totals as they affect financial plans, and the merchandise manager is concerned with the departmental allotments. Since stock shortage is an ever-present evil the store is interested, and the controller is responsible for the distribution of merchandise charges to the proper departments, and later for the correct departmental distribution of credit for sales and reductions. Some stock goes to reserve stockrooms, in the nature of storage warehouses, and it must be protected and duly accounted for. Claims against resources for short shipment, damage, and other causes, and particularly for returned merchandise, present a collection problem which the controller must meet. In the case of returned or returnable merchandise the financial standing of the resource must be passed upon before shipment, and it is often necessary to require selling departments to retain the merchandise and dispose of it as best they can rather than risk the collectibility of a claim against a risky resource.

Still another problem put up to the controller in connection with the purchase of merchandise is the best method of financing foreign purchases when the company maintains offices abroad or imports direct through commissionaires. Since 1918 this has been a real problem for which even yet there is no adequate banking machinery abroad that may be utilized at reasonable expense.

In the protection of accounts receivable the work of the controller varies considerably with different industries. Although he has nothing to do with the selling end of the business he is directly responsible for outstandings, and the credit department is often one of his most important operating units. If his company's business is wholesaling or jobbing he has one set of conditions altogether different, for instance, from those to be met in handling retail credits. In the one the element of financial responsibility is paramount; in the other it is of minor importance compared with the predominating elements of moral risk and habits of pay.

It is the controller's duty to protect his company against loss in the collection of accounts receivable, beyond the normal and unavoidable percentage of loss that goes with credit granting, and it is his desire to increase sales by accepting every possible account. Between two fires, and with only the broad general policy of the company to guide him, he must define the methods and the more detailed policies to be followed in granting, controlling, and collecting charge accounts. The credit manager and his department come directly under the controller as the only means by which he can keep himself properly informed to protect what is in many businesses one of the largest single assets and one of the easiest to get out of hand. Anyone can make a good collection showing, but it takes a real credit manager to maintain his collections and retain the good-will of his customers at the same time. Particularly in retailing, the credit manager is one of the most important executives of the controller's group.

It is not the purpose of these articles to catalogue the duties of the controller but rather to point out his province and the relation of his duties to those of the other major executives. What has been said will indicate something of the nature of his duties in the protection of assets and in the operation of his supporting departments. The concluding article concerns itself with his work as an analyst and economist, showing how he uses the information that comes to him through his departments, how he combines it with statistical and comparative data that he obtains from other sources, how he interprets and reports the results to others in the organization and what effect it has in forecasting and budgeting future operations of the business with which he is connected.

(To be continued in the September issue.)

Coal Storage at the Robert Gair Company Plant

By J. A. BECK

Mechanical Engineer

Class Number
658.68: 662.65 Coal storage

THE necessity for storing coal has resulted in the development of several different types of conveying systems for the purpose of handling the fuel. Many of these have been rather elaborate, somewhat expensive to install, and costly to maintain in operating condition. Others were limited in their ability to handle large quantities quickly and to effect a distribution over a wide area.

The more common methods of mechanically storing

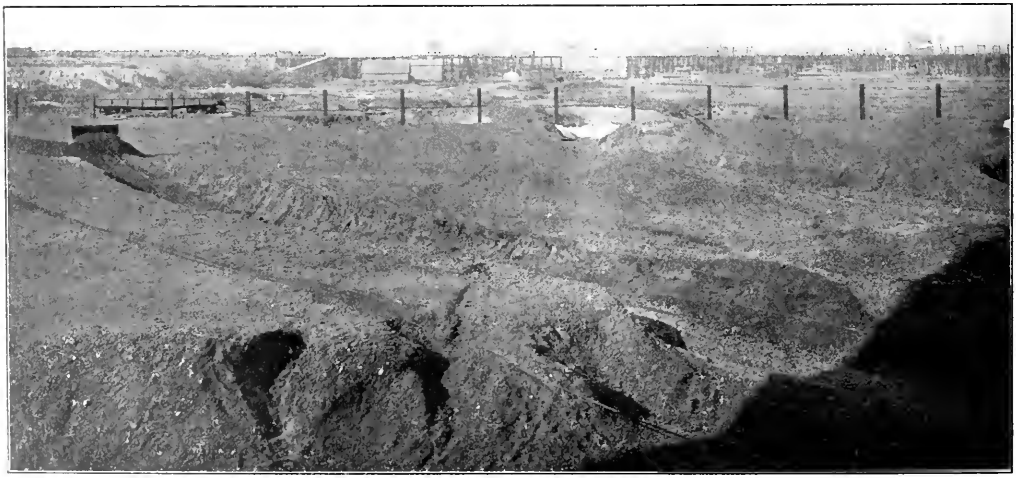


FIG. 1 STORAGE YARD IN WHICH 11,000 TONS OF COAL ARE HANDLED YEARLY

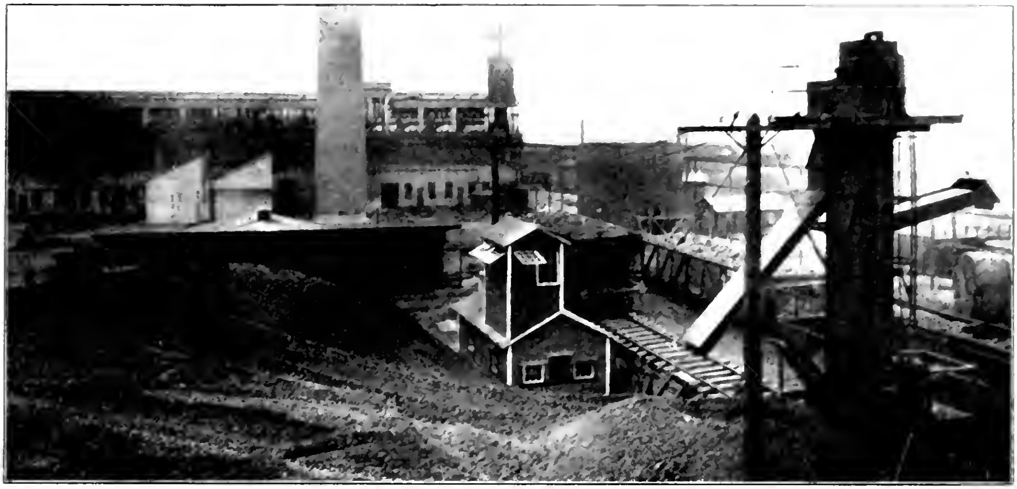


FIG. 2. COAL IS MOVED BY CARS FROM BARGES TO THE ELEVATOR AND CHUTED TO THE SCRAPER

coal have consisted of portable, or bucket conveyors, for use in small storage piles; and grab buckets with cars, grab buckets with conveyors, and fixed conveyor systems for storage piles of large capacity. As the portable conveyor is loaded by hand its capacity is limited by the quantity that can be shoveled on it per hour. When the lower end of the conveyor is run into a pit below the railroad track, and fed by a mechanical feeder, it becomes a fixed conveyor system, and though it has a greater hourly capacity it is less flexible than when free to move to any point.

The fixed conveyor system consists usually of a V-bucket elevator conveyor, which receives the coal from a hopper beneath the track, elevates it about 20 ft. and then runs horizontally, dropping the fuel through gates to storage. The return of this conveyor operates in a tunnel beneath the coal pile. The chief defect of the system is that only half the coal can be reclaimed from storage, without recourse to other handling. This same objection applies to monorail, or other straight-line storage systems, which pile the material in long triangular-shaped heaps, half of it being out of reach of the reclaiming bucket.

Systems embodying the grab bucket and conveyor consist either of locomotive cranes and reclaiming belt conveyors, or of bridge cranes operating a grab bucket and provided with a similar conveying unit. Conveyors are used in conjunction with cranes because the latter cannot advantageously pick up a grab load of coal and travel with it.

Certain disadvantages of these systems have resulted in the designing and introduction of the cable drag scraper for storing and reclaiming coal. The cable drag scraper system consists of a steel scraper (see Fig. 1) attached to an endless steel cable, which latter is operated by a double drum winding machine and runs out across the yard to steel posts planted around the storage area.

During 1921 this system was installed at the Robert Gair Company plant in Montville, Connecticut, and it has been in continuous, successful operation. The use of the scraper method has made possible the storage of approximately 11,000 tons of coal annually at a labor cost of less than one cent a ton. The depth of the pile averages 15 ft. and 60 tons an hour are handled.

Coal is received at the plant in barges containing 600 tons, and is unloaded by a grab bucket, which hoists the coal and dumps it into an automatic shuttle car. This car carries the coal back to a chute and drops it to the ground to form the initial pile for storage. (See Fig. 2.) The drag scraper, which has a capacity of 60 tons an hr., hauls out its loads from this pile and distributes the fuel to all points of the storage yard. The bucket is quickly detachable and can be turned around when the coal has to be reclaimed.

At the side of the storage yard is built the machinery house and operator's cabin where the winding drums are housed. From this cabin the operator controls the scraper, having a clear view of the yard at all times. Should the coal heat he can make the scraper attack the

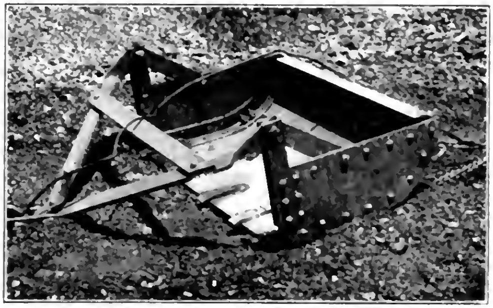


FIG. 3. THE SCRAPER, WHICH DOES ITS WORK AT ONE CENT PER TON

heated area and turn over the pile at that point. On account of his remote position he is not troubled by smoke or fumes. If a crane were used it would have to dig out a large body of coal that is not in the least heated, in order to reach that which is burning, or nearly burning, beyond.

A system of this kind tends to remove the danger of spontaneous combustion. In storing the coal, lumps and fines are mixed thoroughly together and there is practically no tendency for the coarse material to collect at the bottom of the pile, forming air pockets which prepare the way for spontaneous combustion.

The mechanism of the system is simple and does not involve a large outlay of capital. Operating expenses are low because ordinary labor can be employed to run the machine Should it become necessary at any time for the owners to change their present storage area they will find the drag scraper system has a high salvage value because of its mobility. The only connection between the machinery house and the back posts is the cable and it will fit any storage area. The machinery house can be set anywhere. Thus, the entire

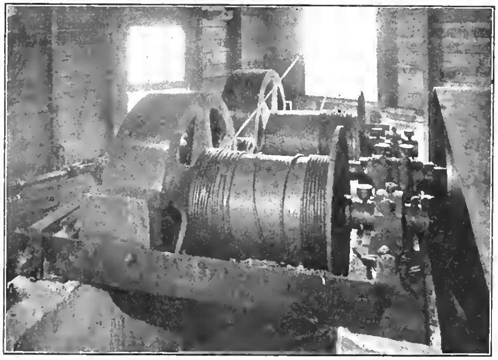


FIG. 4 DRUMS, CABLES AND FRICTION DRIVE FOR SCRAPER

plant can be moved to a new location very cheaply. An extension of the present storage area involves only the installation of additional back posts.

Description of the System

The scraper is built of steel plate, substantially reinforced with flat irons. It is attached to the cable by special clamps, so that it may be easily reversed, and has a rounded back, which offers a low resistance when returning empty over the coal pile. Sharpened tool steel teeth are provided along the digging edge of the bucket to assist in loading. A hinged bale allows adjustment of the angle of the scraper when storing or reclaiming coal. (See Fig. 3.)

The driving drums, Fig. 4, are made of cast iron, with large friction wheels, each drum being cast in one piece with its wheel. Between the drums is located the driving shaft, connected by a belt drive to a continu-

FIG. 5 THE SCRAPER HANDLES 60 TONS OF COAL PER HOUR

ously running motor. On this shaft is a fiber friction pinion, which engages the large drum wheels. The drum shafts are each mounted in spherical ball and socket bearings on one side, the other end of the shaft being supported by an eccentric bearing, the arms of which are connected to the single control lever by rods.

When the system is in operation the motor runs continually, the control lever being in "neutral" when vertical. Throwing the lever forward causes the rear drum friction wheel to engage the fiber friction pinion, the other drum running idle and receiving its momentum from the unwinding rope. To prevent this drum from gaining in speed, an automatic counterweighted brake is used. The machine is reversed by throwing the control lever in the opposite direction, when the brake will be automatically applied to the other drum.

The machine is mounted on cast iron base plates, which contain screw adjustments for all bearings. It is located in a wooden machinery house away from grit and dirt. The operator's cabin is above the machinery house. A grating is placed in the floor to permit the operator to see the drums while working. Ample windows are provided to insure a clear vision of the yard at all times.

The largest part of the investment is in the steel and concrete, which have a very low depreciation value. When the machine is idle the rope is wound on the drums and the scraper is stored anywhere under cover, the only parts exposed to the weather being the machinery house and back posts. The moving parts consist of the driving drums, rope, scraper, and sheaves, and most of these are steel. The equipment is simple in design to avoid the wear and tear incident to complicated mechanism.

Coal is stored for insurance against shutdowns and should not be rehandled unless necessary. The simplest and least expensive machine, therefore, should be used for this purpose to reduce carrying charges on idle equipment. The scraper system offers a ready means for handling large quantities of the fuel in a storage yard (see Fig. 5), and the reclaiming can be accomplished with the same ease and speed as the storing.

Sharing Gains With Employees

Examples of a Practical Incentive Plan

By W. L. CHURCHILL

Index Symbol
658.3123 Wage-payment plan
658.551 Wage-incentive plan

MANUFACTURERS as a class are prone to believe that piece-work is the fairest and most equitable method of wage compensation. Most of them honestly believe that it is of as much benefit to employees as to themselves, and not a few offer it as a means to enable employees to earn higher wages than prevail with straight day or week work. The general reason for its adoption by employers is in their belief that it prevents costs going above established figures, thus insuring them against loss from underestimating their labor charges.

Evils of the Piece-Rate Plan

The underlying and unavoidable evil of the piece-rate plan is that it caters to the individual selfishness of employees working on this basis. The employer, in turn, is also encouraged to develop selfishness that often drifts into greed, and to use unfair and even fraudulent methods to inflate his earnings. The public loses because, in the last analysis, piece-work leads to higher costs of production, fans the fires of antagonism between capital and labor, and hinders the development of co-operative understanding and mutual help that a well-considered plan of wage payment should secure.

Looked at from the standpoint of the worker, some of the objections to piece-work are:

1. It is unfair, because it is limited in application, thus permitting a privileged class to earn more than others of equal or greater ability and industry.
2. It destroys initiative, ambition, and interest by converting the worker into an automaton.
3. It not infrequently develops serious physical and mental ailments on account of the unnatural and monotonous strain forced by the need to earn as much money as possible over a long period of service.
4. It destroys opportunity for the development of friendly co-operation with fellow workers, as the intensity of effort required prevents all other considerations except the work in hand.
5. It limits opportunity for growth in usefulness and for promotion by confining workers to a few simple automatic motions, out of contact with the general purpose of the work they are engaged upon.
6. It penalizes workers when work is interrupted by causes beyond their control.
7. The unnatural continuous strain of application to a single routine task causes irritability, moroseness, and generally destroys the social and human qualities of the workers.

From the standpoint of the foremen and others in authority it has, among other evils, the following:

1. Foremen are often humiliated and made resentful by piece-workers earning more than they do. This lowers morale and encourages partiality and other unfair tactics.
2. Co-operation of employees with their foremen is destroyed, and foremen cannot assign the most suitable persons to different tasks at will.
3. Foremen are obliged to spend much of their time in preventing piece workers from passing inferior or defective work, cheating in their accounts, and concealing their actual ability to produce. This makes a foreman often more of a spy and detective than a real instructor and director of the workers under him.
4. Opportunities for cheating both employees and employers are thrown open to foremen.

The evil effects upon employers are more vital. Among these effects are the following:

1. Piece work prevents cost reduction but does not prevent its increase.
2. It compels so much additional expense for supervision, inspection, spoilage, customer claims, and lack of production, that, in most cases, the direct net results are a loss rather than the supposed gain.
3. It encourages employees to keep costs at the highest possible point rather than to co-operate in their reduction, thus creating antagonism between employers' and employees' interests.
4. The sense of employer unfairness developed in the day workers' minds on account of their lesser earnings, automatically enlists all piece-work employees of an industry against the employer, to his ultimate loss.

General welfare is affected because the public:

1. Pays more for goods made under piece-work conditions than under more co-operative wage plans.
2. Gets inferior products, but at no reduction in price.
3. Stands the losses due to strikes and disagreements incited or augmented by the piece work systems.

The gain sharing plan of wage payment has decided advantages over the piece rate plan. It stimulates production and rewards both employer and employee for the extra effort.

Manufacturers in establishing selling prices of their products can logically figure only on the normal cost of production, and this normal cost should be passed along to the customer in the selling price. The manufacturer who, by wise selection, intelligent supervision, and attractive compensation, is able to get more than normal output from his employees, makes a profit in excess of that which he would make without this greater and more intelligent co-operation of his employees.

Returning Gains to Employees

The wise employer will return a substantial portion of these gains to the employees effecting them, since this increases their compensation and develops a co-operative interest that encourages still further gains. Even if the employer returns to his employees all of the gains they make, he will still benefit because of the increased production. However, if he reserves a share for himself, the whole system gives better results, for then the employer has a direct incentive to supply conveniences and rearrange methods where additional savings seem possible. Moreover, if the employer guarantees a minimum daily wage to all workers, and at the same time does not share directly in any gains, he labors under the disadvantage of taking all risks and losses with no compensating opportunity to benefit from savings in production.

Whether job analysis, past history, or mere estimate is used to determine the normal output upon which to base a gain-sharing system, the principle is the same. An exact basis, however, enables a manufacturer safely to quote prices on a closer margin and to secure contracts which he might otherwise lose.

The half-and-half ratio of gain sharing offers too little incentive to employees. Experience has shown that apportioning two-thirds to workers and one-third to the employer produces the best results. With enough at stake in the way of reward, employees will give intelligent estimates on work, and will even get together and pare down costs when challenged by the need of meeting an underselling competitor.

All Labor Should Share in Gains

All labor, direct and indirect—foremen, inspectors, supervisors, helpers—should have a part in the gains distributed. Even the office help, superintendents and sales force may be included. By departmentalizing the plan, either according to the organization scheme of the plant or by grouping divisions, credits and charges can conveniently be made. Hours credited to any department (on the basis of normal established time for the same amount of work), minus hours actually taken to turn out the work during any day period, give the gain for that day period. Record of individuals need not be kept.

For example, if during a pay week the deliveries from a department of 20 people represent 1035 hours' worth of work done, while the actual time taken has been 900 hours, this department has delivered 135 hours more of work than under a non-incentive scheme, or a gain of 15 per cent. If the employees get two-thirds of the saving they receive an amount equivalent to 10 per cent of the department pay-roll.

In order to eliminate the question of wage rates, the plan measures output in terms of hours of effort rather than in wages. For instance, when a department turns out an article in 20 hours at a cost of 50 cents per hour, it receives credit not for $10 but for the 20 hours of work. This leaves the question of specific rates in such shape that in cases of increasing wage rates, the gains automatically go up with the wages.

Under the gain-sharing plan weak groups or departments stand out at once. They may be strengthened, or, if the factors of weakness are within their own control, they will strengthen themselves in order to share more largely in the savings.

Gains from Saving Materials

In addition to the possibilities of gains being made on normal labor costs, there are in many businesses opportunities for employees to make gains on the normal consumption of material required for the production. In one instance, the shoe cutters of a large shoe factory were able to increase the yield from the leather furnished them by 3 per cent. That is to say, when the incentive was offered, as a result of their co-operative intelligence, they were able to get 103 pairs of shoes from the same quantity of leather that formerly made only 100 pairs. As this gain of 3 per cent in material utilization was equivalent to saving more than 30 per cent of the pay-roll, giving the cutters 15 per cent above their usual wages was very profitable for both the employer and employees.

Methods of Distributing Gains

The simplest method of distributing gains to the employees is by paying each employee an amount equivalent to the percentage that the gain represents to the total pay-roll. There have been elaborations on this plan devised for such purposes as encouraging continuity of employment and 100 per cent attendance by paying larger percentages to employees who qualify under these heads. In a few instances, employees are required to have been on the pay-roll for a definite number of days or weeks before they get any share in the distribution, on the theory that instruction of newcomers interferes with production and absorbs the time of other employees to the extent of reducing the total gains, and cutting down the income of the older employees. In some instances a portion of the gain is set aside for a reserve to provide for distribution when gains may be lacking. In other instances, portions of the gains are used for group life insurance, sickness and disability benefits, etc.

The most generally satisfactory period for distribution to take place seems to be every four weeks, or monthly, although many prefer to make the distribution with each pay, while others make it only once in three months. The principal objection to weekly distribution is that in most lines of manufacture a variation in the amount of work that may be in process from one week to another is sufficient to make very erratic and unsatisfactory variations in the amount of gain sharing. This condition, of course, can be overcome by inventorying the "in-process" labor, but, as a rule, the results hardly justify the trouble.

There is, however, one decided advantage in distribution with each pay period, in the fact that it stimulates employees to complete at once all work possible, thereby insuring more prompt deliveries of product to customers than when the distribution is but monthly. Sometimes an element of chance is injected by making distributions only when accumulated funds aggregate a certain minimum amount. This, however, is not very businesslike, as it prevents workers from knowing what to expect the extra income.

Amount of Gains

The amount of gains it is possible to earn depends upon the difference between established normal requirements and the possible and normal output per employee. Based on a wide variety of experience it has been found that the difference between individual normal output and theoretical possible output is about 50 per cent. That is to say, the average employee produces two-thirds of what it is theoretically possible for him to produce. There appears to be a similar spread between the theoretical possible output of groups of employees and their average performances. It has been found, in establishing normal ty standards from scientific studies of theoretically necessary labor for a given task, that as high as 125 per cent should be added to arrive at what can be normally expected from a large group of employees engaged in turning out the product represented by such studies.

In the conservation of materials there is less definite data. Nearly every class has to be considered on its own merits. In many instances materials are of low value, so that gains made in their conservation have but little effect upon possible earnings. In other instances materials are of very high value, so that even slight gains made in conservation add substantially to earnings of employees.

Gains Average From 15 to 30 Per Cent

Based on average results in many installations of this type of co-operative gain sharing, the automatic effects of the plan itself average about 15 per cent increase in labor output per employee. Where employers co-operate with their workers and do their share towards keeping up interest and enthusiasm, it is not unusual to have as high as 30 per cent increase in labor output per employee. As a rule employers do not give as much attention to the encouragement and development of gains as they might, so that the average of gains made under all conditions is probably 20 per cent.

The principal danger of the plan is, that an unscrupulous or unwise employer is liable to use it as a means of developing better than average output from his employees, and then, on the assumption that he can hold them to such standards of production, he will cease sharing the gains with his workers. Another danger is, that this type of employer cannot, as a rule, look with favor upon the distribution of gains in excess of regular wages, and even if he does not abandon the payment of gains, he is liable to revise the basis for these gains so as to reduce the amount to be disbursed to employees. A third danger arises from the fact that, as extra earnings go to employees on such a plan, outsiders may offer to work for less than established wage rates, for the sake of making the substantial extras. Extra earnings are also sometimes used by employers as a basis for refusing increases in day or week wage rates to individuals who may be deserving of them.

The danger to employers that workers will take un[illegible] [illegible] system. [illegible] simply [illegible] total wages. [illegible] with group [illegible] sible self stress [illegible] made by [illegible] to "lay down" [illegible] fail for any considerable [illegible] ployees respond [illegible] greater collective interest [illegible] On the contrary, the hesitation [illegible] always been due to the fact that the particular employer under consideration has [illegible] gence to continue to get the best benefits from [illegible] making it continuously profitable to his employees.

Shortsighted Policy of Certain Employers

It is strange but true that certain employers are possessed of a cupidity that outweighs their judgment and sense of fairness. In questions of wage payment they do not hesitate to be unscrupulous. They will hold out the incentive of greater earnings to employees only to back out of the arrangement, if at all possible, when the time comes to reward the workmen. When the saving has been made and the money is in hand the temptation to hold onto it is too great to be overcome. Their own unwillingness to make good leads them to suspect a similar lack of reliability on the part of their employees. Time and again, by one means or another, they will try to stimulate production by promising to give the workers a share in the gains, and then they will hunt for some excuse to keep the increased profits themselves. The continued response of employees, often in the face of repeated discouragements, shows that they are not to blame for the final failure of the scheme. The employer is always the one who is blind to the benefits of the plan and when it has to be abandoned the cause is one for which he is responsible.

Two actual cases illustrate the shortsighted policy of certain employers:

Example 1. A department of 35 employees—31 of whom were piece workers, with 2 day work truckers, one inspector and one foreman on day work—increased their output 31.6 per cent inside of six weeks from the introduction of the gain sharing plan. In this case employees were paid 50 per cent of the gains, the former piece workers being put on day rates equivalent to their previous average piece work earnings. Under the new arrangement, all, including the foreman and other day workers, earned over 15 per cent more money than before.

This case was one of the first to illustrate the folly of employers. The fact that these workers made much more money than formerly, was used as a justification for abandoning the plan, and putting all the employees in the department on a day work basis on a par with other day work labor in the plant. Naturally, such action destroyed the usefulness of the plan for the other 3000 employees of the concern.

Example 2. The executives of a large pulp board and paper mill needed a 30 per cent increase in output to keep up with their sales. It was impossible to install additional machines, so they were asked to give their employees one third of the gain that they would collectively make with an increase in production; that is, if the employees would increase the output 30 per cent they were to have only 10 per cent increase in money. This arrangement was accepted, and the average cost of the six grades of product made for the previous 8 months was used as a basis for normality.

The more than 400 employees responded immediately and lifted the production well past the required amount. When the date for distribution of the first gains arrived, the employers refused to make good. After several days of bickering they finally consented to a distribution based on a 10 per cent increase over the normality rate.

Despite this unwise procedure the employees made still further gains, but when the date arrived for the second distribution the employers again reneged on their agreement. A second series of bickerings and another increase of 10 per cent over normality took place. Not discouraged by this unfairness on the part of their employers the workers responded for the third period, after which the plan was abandoned.

The president of this corporation was indicted and imprisoned at Atlanta for violation of the Sherman Anti-Trust Law. This fact simply shows that the type of man who will abuse an advantageous method of dealing with his employees is very apt to be unscrupulous in all his business dealings.

Examples of Good Results

Not all employers, however, are so obtuse as to fail to recognize and properly to use this plan, which, in addition to increasing profits, often solves serious problems. The following cases illustrate the results of intelligent handling of the plan:

Example 3. The largest jewelry manufacturing plant of its line in the United States needed to increase its output 50 per cent, and to add 300 more people to its force, already numbering 1200. The gain-sharing plan was adopted and put into effect in the latter part of June. For the month of July the output increased 50 per cent, and by the end of the month the full quota of additional employees was filled.

In this case the employers had kept careful tab on the production for several years, and had established average costs covering their vast variety of products in each of their many departments. Although there were wide differences in normal costs of different styles in the same class of product, yet, on account of the limited time in which the increase could be of benefit to the workers, these average costs were accepted and used as a basis for gains.

This particular plant increased its business for the year 85 per cent over any preceding year, largely as a result of the co-operation of its employees. The plan was extended to cover even the sales branches, and offers a conclusive demonstration of the benefits to be derived by intelligent gain-sharing.

Example 4. A manufacturing plant in northern New England employing about 150 people put the plan into effect in 1915, using carefully studied standards as a basis for establishing output normality. At the end of 11 months the average output per employee had increased 34 per cent. At the end of 1922 the average output per employee had increased 50 per cent.

This plant was formerly losing money. It began making profits right from the start of gain-sharing, and today, with an average force of 175 people and a much greater production, it is paying attractive wages and dividends. The employer shares his added profits with the public by reducing selling prices. More goods are sold, which, in turn, increases the total volume of profits to the employer, and provides an opportunity for the employees to make still further gains.

Piece-work has practically outlived its usefulness. It is a poor substitute for good supervision, and good supervision, although needed to get the maximum of co-operation from regular day-workers, and week-workers, is becoming harder and harder to secure. A financial incentive is necessary that will encourage workers to use their own intelligence and initiative to greater extent, thus eliminating the need for high-grade and high-priced departmental supervision.

Gain Sharing Offers the Required Incentive

The plan as outlined here effects just this. It also does more, as it interests the employees in exactly the same thing that is vital to the employer—shipments, the source of plant income. It means that all are interested in producing in the quickest possible time the goods that customers need. The plan, properly applied, discourages the accumulation of an excessive stock of processed or partially processed parts. All sorts of special features can be added, such as special extras for getting goods out on definite dates, or for improved products, or specific and appreciable cost reductions brought about by revised methods.

Its intelligent application removes the evils of piece-work and overcomes the restrictions of day-work. It induces in employees a definite interest in their collective activities, which increases their earnings, increases the profits of employers, and reduces the cost of products to the public.

In other words, while not a cure-all for industrial ills, it offers undoubtedly the best basis upon which to deal with workers and obtain every element of fairness for both sides. It has a large number of incidental advantages that react to the good of manufacturing. No guarantee is implied under this arrangement that anything but the earned wages plus the proportional share of the gains will be paid. Special awards or bonuses are regarded properly by the workmen as something to be tried for and not as something to which they have inherent right. Yet, where special rewards are deserved and conditions warrant their presentation, the management has a ready means of at once making such distributions.

The corps spirit induced by such a plan when carried on year after year is very marked. In the plant cited in Example 4, where the plan has been in operation since 1915, group life insurance with sickness and disability benefits has recently been instituted. The insurance people remarked that they had never done business with a group of employees that seemed to be so thoroughly and intelligently interested in a business and all that pertained to it, as this particular body of employees seemed to be.

The principle of the plan is the same as advocated by Halsey in the Halsey Premium System. The Committee on Awards and Prizes of the American Society of Mechanical Engineers has recommended that the A. S. M. E. medal for the year 1922 be awarded to Frederick A. Halsey, of New York, for his paper presented in 1891, describing the principles of this system. Such a disinterested and authoritative endorsement of the plan offered 32 years ago is at least significant of its established merit and value when properly applied.

Selecting and Placing Technical Graduates in the Westinghouse Organization

By E. B. ROBERTS

[illegible] Westinghouse Electric and Manufacturing C[illegible]

Class Number

658.415 Selection of Employees
658.9:621.3006 Westinghouse Plant Management

FOR over 30 years the Westinghouse Electric and Manufacturing Company has recruited the ranks of its executives from among those who entered its organization at the bottom and have shown capacity to rise. The company believes in the graduates of technical schools. The roll of its vice-presidents, departmental managers, district managers, and works executives contains a liberal proportion of men who entered the employ of the company directly from college as graduate students or "technical apprentices," as they were formerly called. Throughout this period the company has provided in some form or other a systematic, practical shop experience to supplement the theories which have been stressed in college. Several thousand technical graduates have completed the work. Along with other phases of engineering education this course of training has undergone evolution within the last quarter of a century.

The courses originally outlined were several times longer than they are now. Intensive specialized training, involving scientifically devised programs has supplanted the old plan of a general haphazard scheme for all. Formerly the college graduate was considered a necessary evil but now much thought is spent on him and elaborate plans are made to round him out as quickly and as thoroughly as his capacity for assimilating experiences will permit. Along with the increase in attention to the individual it has become the policy of the company to direct its effort toward the careful and intensive training of only a fraction of the number formerly carried on its student rolls. Some years ago, four, five, or six hundred men came in from the colleges and universities each summer and all were given jobs in the shops. Now, however, much care is exercised in making a selection at the technical schools and in developing specialized courses for the more limited number of individuals. At the present time the company takes into its employ each year approximately 150 technical graduates, mostly drawn from the schools of electrical and mechanical engineering, and provides specific courses along application, design, sales, operating, and erection lines. A recent group is shown in Fig. 1.

The selection is made by representatives of the company who visit the leading educational institutions for the purpose of coming into personal contact with can-

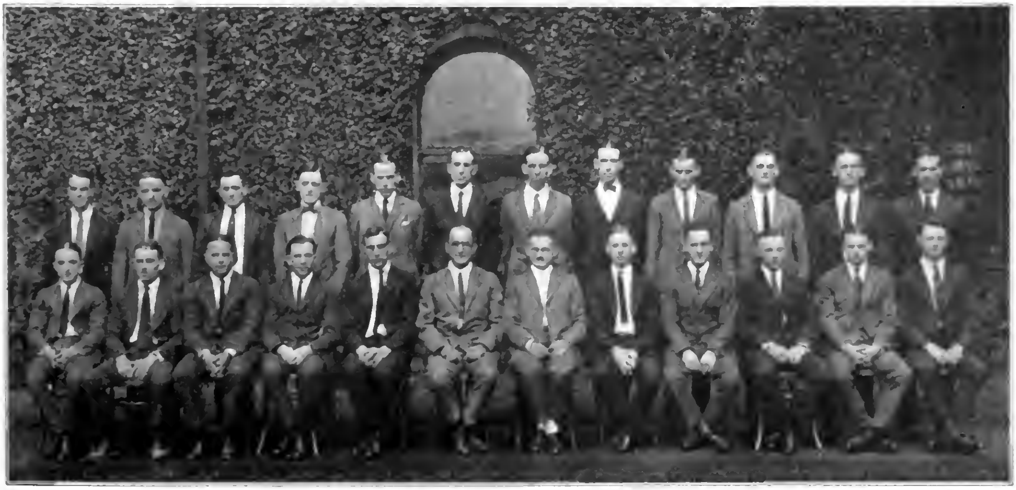


FIG. 1. A GROUP OF TECHNICAL GRADUATES DRAWN MAINLY FROM SCHOOLS OF ELECTRICAL AND MECHANICAL ENGINEERING

THIS SIDE NOT TO BE WRITTEN UPON BY APPLICANT

NAME ____________________

RATING BY FACULTY REPRESENTATIVE

			COMMENTS
QUARTER OF CLASS IN SCHOLARSHIP		☐	
QUARTER OF CLASS IN PERSONALITY		☐	
BEST SUITED FOR	DESIGN	☐	
	APPLICATION	☐	
	RESEARCH	☐	
	COMMERCIAL	☐	
	WORKS	☐	
OPERATING TEST	SERVICE	☐	
		☐	

IF THIS STUDENT POSSESSES A HIGH ORDER OF ANALYTICAL ABILITY CHECK HERE ☐

DATE ____________________ SIGNED ____________________

RATING BY INTERVIEWER

		COMMENTS
I. PHYSICAL QUALITIES—PHYSIQUE, BEARING, NEATNESS, VOICE, ENERGY, ENDURANCE (CONSIDER HOW HE IMPRESSES MEN IN THE ABOVE RESPECTS)	HIGHEST 20 HIGH 16 AVERAGE 12 LOW 8 LOWEST 4	
II. INTELLIGENCE—ACCURACY, EASE IN LEARNING, ABILITY TO GRASP THE POINT QUICKLY, TO EXPRESS HIMSELF CLEARLY, AND TO ESTIMATE A NEW SITUATION	HIGHEST 20 HIGH 16 AVERAGE 12 LOW 8 LOWEST 4	
III. LEADERSHIP—INITIATIVE, FORCE, DECISIVENESS, TACT, HELPFULNESS, ABILITY TO INSPIRE MEN AND TO WIN THEIR LOYALTY AND COOPERATION (CONSIDER PART TAKEN IN STUDENT ACTIVITIES).	HIGHEST 20 HIGH 16 AVERAGE 12 LOW 8 LOWEST 4	
IV. PERSONAL QUALITIES—INDUSTRY, DEPENDABILITY, LOYALTY, READINESS TO SHOULDER RESPONSIBILITY FOR HIS OWN ACTS, FREEDOM FROM CONCEIT AND SELFISHNESS, READINESS AND ABILITY TO COOPERATE, AND CHARM OF PERSONALITY, BREADTH OF CONCEPTIONS	HIGHEST 20 HIGH 16 AVERAGE 12 LOW 8 LOWEST 4	WORK BEST SUITED FOR ______ ACCEPTANCE (WRITE YES OR NO) ______ NEXT ACTION PROMISED BY INTERVIEWER ______
V. GENERAL VALUE TO THE COMPANY—SPECIAL TALENT (COMMERCIAL, MECHANICAL, MATHEMATICAL, EXECUTIVE), GETS RESULTS, WORKS WELL IN AN ORGANIZATION. SPECIAL INTEREST IN W. E. & M. CO. PREVIOUS TRAINING AND EXPERIENCE. WILL DEVELOP	HIGHEST 20 HIGH 16 AVERAGE 12 LOW 8 LOWEST 4	SIGNED ______ INTERVIEWER TOTAL ☐ DATE ______

RESERVE THIS SPACE FOR FILING

FIG. 2. REVERSE SIDE OF THE STANDARD INTERVIEW BLANK, SHOWING THE FIVE MAIN POINTS OF THE RATING SCALE: TECHNICAL QUALITIES; INTELLIGENCE; LEADERSHIP; PERSONAL QUALITIES; AND GENERAL VALUE TO THE COMPANY

didates. Scholarship is not the criterion on which judgment necessarily is based. A rating scale, somewhat similar to that devised for the rating of officers of the army is used. The five points upon which scores are given are: technical qualities; intelligence; leadership; personal qualities; and general value to the company. Some detail as to just what these points cover may be had by reference to the reverse side of the standard interview blank (see Fig. 2). A five-point scale is used on each of the qualities and rating is in terms of men who entered the course the preceding year. This enables the interviewer or any executive before whom the matter may come to form a definite idea as to how any young man under consideration will rank as compared with those whom he knows personally and is at the time in contact. An average of 60 would mean that he is as good as the average man. If higher than 60 he is that much better than average.

This process of selection at the technical schools is generally compl[illegible] several months in advance of the time of graduation, and the time during which the men report for work extends through June, July, August, September and October of the year of graduation.

After a man has started his work in the shops the next important step is to acquaint him thoroughly with the work of the various departments, commercial, manufacturing, designing and application. To do this he is called upon to read an analysis of the work of each department, each having been prepared by the executives in charge of the different phases of the company's activities. These statements were prepared from a standard outline covering the organization of the department, the nature of the work, opportunity for advancement within the company's organization, and the field for advancement with other companies.

After a careful questioning shows that the candidate has rather thoroughly digested this material he is given an opportunity to meet the executives along the two or three lines which most appeal to him. This usually results in the selection of a particular kind of engineering work; that is application, research, design, commercial, publicity, service or operating, so that the subsequent training can be more definitely directed. The matter of deciding what particular department of the company or what particular operating company a student wishes to enter is a matter of detail and can be decided better later. As soon as a decision as to the function or the classification of engineering work is made, the personnel in charge of training can intelligently plan a program for the individual. Details of these programs are quite elaborate and need not be discussed in an article of this kind.

During the past five years an investigation has been conducted into the possibilities of making a decision on the basis of psychological tests, as to what particular type of engineering work engineering graduates are best fitted to perform. While some positive results were obtained, in general it is the feeling that while psychological tests may be used as an adjunct means in making this important decision, the tests have not yet been developed to the point where they could be relied upon. With the technical graduates who entered in one year it was found that had the dictates of the psychological tests been followed, rather than the interests of the men backed up and substantiated by the opinion of various executives, 86 per cent of the men would have been assigned as they actually were. For

[illegible] conditions.

The plan [illegible] tests was to [illegible] which was of [illegible] breadth of interest [illegible] *telligence* or engin[illegible] used were developed [illegible] through the co-o[illegible]

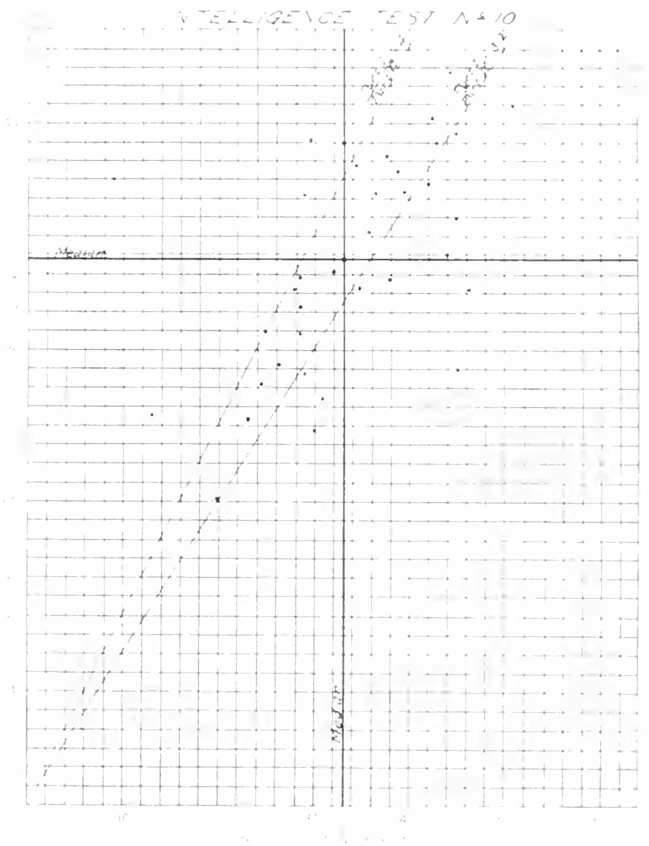


FIG. 3. RECORD OF A [illegible]

Bureau of Personnel Research of the Carnegie Institute of Technology. Dr Bruce V. Moore[1] conducted the investigation on the part of the Bureau and his report[2] on the matter has already been published.

It was assumed in the use of the test that a relatively high standing in general interests, as compared with technical knowledge, should indicate a stronger tendency toward the commercial or manufacturing phases

1 Now Assistant Professor of Psychology at Pennsylvania State College.

2 "Psychological Monographs," Vol. XXX, No. 7, pp. 1-8, 1921.

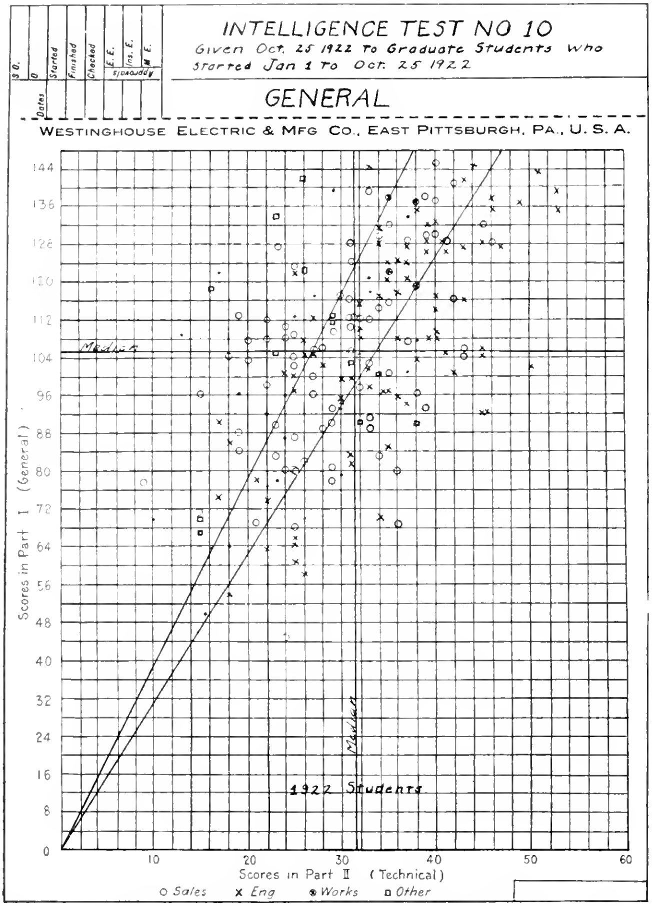


FIG. 4. CHART SHOWING THE SCORES OF NEARLY ALL TECHNICAL GRADUATES ENTERING THE EMPLOY OF THE COMPANY DURING 1922

of engineering work, as opposed to the design or research phase of it, and that the opposite of this was also true.

The young men were given the tests in groups usually of 20 or 30 and the absolute scores in the general and technical tests were plotted against one another as ordinates and abscissæ. In Fig. 3 the record of a typical group is shown. The median lines were drawn with each group so that accurate records could be kept of the way in which groups compared with one another or how technical graduates from one year compared with those of another. The diagonals (part one divided by part two equals 3.2 and 4.0 respectively) divide the commercial and manufacturing groups from the design and research groups. The position of these lines was determined on the basis of the data obtained by giving the test to selected groups of men several years out of school and whose success in their chosen field seemed assured.

It is in the cases of the men whose scores bring them within the area of the angle formed by the two lines that the test fails. One of the observations was that a very considerable portion of the men will fall within this angle. The plan without a doubt picked 15 or 20 per cent of the men distinctly for the technical side of the work and another 15 or 20 per cent for that phase of the work in which human interest bears more important relation. But these were the men about whom no doubt existed. It was the other 60 to 70 per cent that most needed help and enlightenment, and here the test failed to function.

One positive result obtained, however, is found in the shifting of the median lines from time to time, which affords an indication as to the relative quality of the incoming men. On this basis there is no doubt at all but that technical graduates of the colleges of the year 1923 and 1922 were very much better informed both on general and on technical matters than the graduates of two or three years previous.

A chart containing the scores of nearly all of the technical graduates who entered the employ of the company during the year 1922, and separating them into those who elected commercial, engineering, and manufacturing, indicates the uncertainty of results obtained. See Fig. 4.

As a supplement to the test there was included a part known as "Record of Interests." In this part were asked and recorded the answers of certain questions such as the following:

1. Did you ever make or build any mechanical toy and if so what did you do with it; that is, did you sell it, trade it, use it, or keep it without using it?
2. What magazines do you read?
3. What honorary and social fraternities have you joined?
4. Do you enjoy yourself at dances, smokers, etc.?
5. What is the occupation of your father or brothers, etc.?

A plan was devised for systematically scoring these interviews and making them a permanent record. It was felt that this method of systemizing this information was helpful in correlating efforts of various executives in definitely assigning the young men to their work.

After approximately nine months of shop experience graduate students are pretty well determined in their own minds as to just what particular phase of work they shall enter at the conclusion of their training, and they are ready for some of the more highly specialized work having a more direct bearing on the position ahead. Special classes varying in length from 30 to 90 days are held.

A Commercial School (Fig. 1) for salesmen includes classes in the company's sales policy, commercial law, business English, business letter-writing, salesmanship, business ethics, and related subjects. For all of this work special textbooks have been devised and lecturers of the company's leading men in the particular phase of work are represented.

For designers, research men, and application engineers an Engineering School (Fig. 5) of three months provides intensive training on the outstanding features of the design and application of practically every standard piece of Westinghouse apparatus. During this particular period men are continually under the observation of leading engineers of the company who advise and assist individuals in making their final decision as to occupations. The work of the Engineering School consists of but few lectures. Many reports are prepared by the group in order to develop a spirit of co-operation. Quizzes and individual conferences are held. Technical papers are written and presented.

At the conclusion of any course men automatically transfer to the personnel of the department which they have had as their objective. The spirit of co-operation on the part of the older men of the company with the young engineers is a feature of the training program which renders easy the transition from the school to regular engineering work.

Doubtless there will continue to come from the schools young men who can exhibit an engineering diploma but who will never make engineers in the true sense of the word. The proportion of them, however, appears to be decreasing each year.

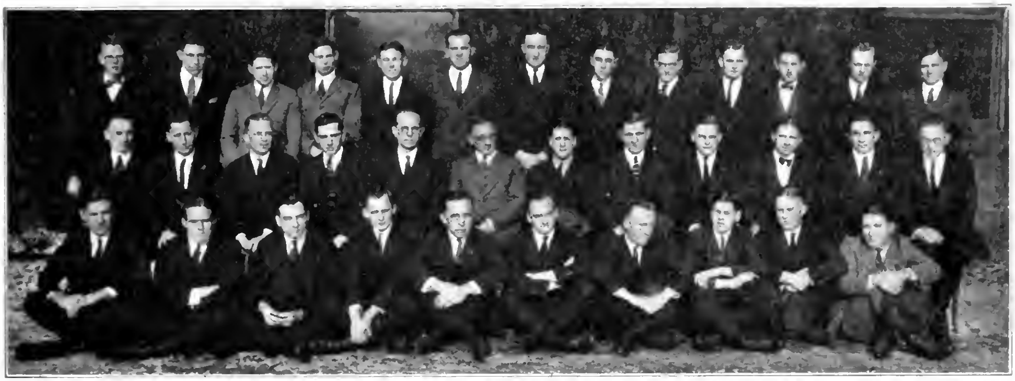


Fig. 5. Students in the Engineering School Which Provides a Three Months' Intensive Training in Design and Application of Westinghouse Apparatus

The Fourth Factor in Production

By PAUL KREUZPOINTNER

PRODUCTION is the basis of the material prosperity of an industrial nation and this material prosperity furnishes the financial means for the upkeep of the governmental, political, civic, cultural, and educational institutions of a civilized country like the United States.

Production by industry has a far more unifying, nationalizing, and socializing effect than production by agriculture, because the industrial products foster the widest development of human activities—exchange and interchange of thought, literature, inventions, discoveries, and transportation. For production to fulfill this nationalizing and culturalizing mission four factors have to combine their social-economic forces; land, capital, labor and technique. The first three have always been component parts of industry even in its most primitive form of handicrafts in the Greek and Roman states, under the rule of the feudal lord, and behind the walls of the medieval monastery. The fourth factor, technique, has entered the arena of industrial production comparatively recently and has not yet succeeded in establishing its claim as a guiding force in the civic and economic life of the modern state.

Class Number

658.01 Engineering Factor in Industry

It is barely more than 60 years since the engineer, representative of technique in its maturing stages, timidly knocked at the door of industry to offer his services in a supervisory capacity. Often enough, he was refused admittance, or if admitted, it was hesitatingly and in a venturesome spirit. The wealth of resources still permitted unlimited waste of time and material, allowing free play to rule-of-thumb and guesswork. The engineer with his technique and science was considered, and to a large extent is still considered, an aristocrat out of place in a democracy like our own.

However, increasing population, decreasing resources, and the competitive struggle between nations, has produced a healthy reaction, and the engineer is no longer the tolerated step-child in the family of industry, but has advanced to advisory and managerial positions, not only in productive industry but also in the civic and social-economic life of nations, becoming the fourth indispensable requisite in the realm of industrial production and transportation. By furnishing applied science, technical knowledge, and economic scrutiny the engineer has become the co-ordinator of the four factors supporting the industrial structure in which are produced the materials necessary to promote an active, comfortable, civic life.

Public Recognition Still Lacking

The engineer has not yet succeeded, however, in inducing the public at large to a realization and deserved appreciation of the value of technical knowledge and scientific research and their application to everyday life. Nor is labor, in particular, as one of the quartet of factors of production, as yet inclined to extend to the engineer and to technique that degree of confidence which is desirable to produce harmonious action in any system of large-scale production. This aspect of the engineer's standing in public and labor confidence is a serious drawback to a strengthening of his individual and professional interests, and no less so in advancing public interests. The average mechanic, leaving out the semiskilled and unskilled, has no use for the "impractical theories" of the engineer, and if, in the course of his work, he cannot avoid coming in contact with the findings of technical knowledge, he does so with resignation, and the feeling that "if it does no good it will do not harm."

It is obvious that, while shop discipline compels the employee to do things as he is told, nevertheless this lack of confidence in the engineer and his conclusions produces a negative factor of unwilling submission or even resistance, which tends to reduce quantitative or qualitative production. To put it differently, a silent force is at work impairing the "morale" of the working force, and costing millions of dollars a year.

Influence of Tradition

The reasons for this attitude are clear. In the first place our actions are still too much under the influence of pioneer habits and traditions whenever economic considerations interfere with these habits and traditions. This is explainable when we consider that up to the middle of the last century almost anyone who could handle a saw, file, and hammer was a "jack-of-all-trades," and woe to the chap who was anything else but eminently "practical" and who did not believe in rule-of-thumb methods and guesswork. Such an attitude was fostered and retained long after industrial progress and production demanded a change of mind, because the wealth of our resources permitted and fostered unlimited waste of time and material.

Moreover, democracies are proverbially ungrateful to public-spirited citizens of progressive tendencies, and dislike experts and expert knowledge. This trait has its origin in the theory of equality in a democracy, the theory being stretched so as to apply to mental equality as well. Therefore the expert is looked upon as an upstart, a disturber of democratic principles, whose college education has stuffed his head with impractical technical theories and nonsense instead of common sense. Other contributing causes of opposition to experts and technique are the experts' interference with preconceived popular notions of health and sanitation and political influences, and the speeding up of machines or otherwise disturbing the acquired humdrum gait. Such factors tend to strengthen the dislike against experts and encourage a disbelief in college education. They go against the grain.

Engineers and the colleges which educated them are largely responsible that so little progress has been made in gaining the confidence of labor and of the public. To send working drawings into the shop with exaggerated mathematical dimensions to which no mechanic could work, and which have to be ignored, is not calculated to increase respect for the engineer's practical training. Likewise, for the engineers to segregate themselves from the social-civic life of the community and, worse still, often make the industrial workers feel that college education produces a mentally and socially superior being, create a social distinction which, in its various reactions, is apt to lower the, perhaps, otherwise laudable efforts for economic production.

The Imperative Need of Social Contact

This does not mean to say that the college-bred man and engineer would not be psychologically and socially different in his whole makeup from the practical industrial worker. Such a difference is unavoidable under any form of government or social status of citizenship. But it does mean, first, that there is an unfilled gap in our educational system, which prevents the industrial worker from valuing technical and scientific knowledge and expert experiences for what they are worth; and, second, that the engineer has not realized to the fullest extent that he is after all part and parcel of the social-economic structure and therefore inseparably bound up with all that pertains to public welfare and well-being. To the extent that the engineer narrows the limits of cultural, educational, and social contact with the outside world, to that extent he deprives himself of the deserved confidence of labor and his fellow citizens.

A broad, liberal, modern education should give the ability to communicate with the world, and to help raise others to a higher level without a feeling of having lowered oneself by so doing. To miss the opportunity of making this social contribution is the more regrettable because it impairs the value of the engineer and engineering at a time when engineering knowledge and guidance in production and in public affairs is becoming more valuable and necessary. By giving too close attention to purely technical subjects engineering education loses in breadth and culture, the students being too eager for practical subjects which contribute immediately to quantitative production. Technical studies alone do not give that broad foundation which raises the engineer to authority, influence, and respectability in civic life.

Working Methods for Profitable Management

VIII—Administering the Business

By C. E. KNOEPPEL

President, C. E. Knoeppel and Co., Inc.

"I DON'T propose to be at the mercy of the unforeseen and the intangible any longer, and for this reason I have called you men together, to begin the work of developing better ways and means of administering our business. Guesswork damned near put this company out of the running; in fact if I had not gone to the mat with my directors a year ago,[1] and secured their consent to put things in shape, we might have witnessed a burial without possibility of resurrection."

This was the answer made by Gibbs, the vice-president and general manager of the Benson Machine and Construction Company, to Thomas Curtis, chief engineer, who had asked him why the matter of administration had been taken up when so much good constructive work had been done during the year. Others in the conference room were James Purdy, sales manager; Alfred Lewis, controller; Walter Cook, purchasing agent; Richard Phelps, personnel director; Thomas Scott, production control supervisor; and William O'Grady, factory superintendent.

"Further, men," continued Gibbs, "it is because you have developed such worthwhile stuff, and secured such excellent results, that I want to take steps to protect ourselves against any possible slips. The churches do not have the only backsliders, you know, and it's going to take a high degree of administration to keep this business machine in good working order and making consistent progress."

"My only point was," said Curtis, "that we have done pretty well this past year, and I wondered if we had missed on anything."

"It's only to protect what we have done so well, that I desire to go into the matter of administration," said Gibbs. "You may remember, Curtis, that early in our deliberations we discussed some lessons from military warfare, the seventh and eighth of which were *competency* and *leadership*. You will also recall that I made a clean-cut distinction between the *executive* side of a business and its *administrative* side. You are here as executives to carry out the desires and policies of the general manager and board of directors, but you are also here as administrators to those under you, as guides, counselors, and creators of better things. These matters of competency, leadership, and administration are what we are here to work out still further in a practical way."

"I get your point," said Curtis, "which is, as I see it, the task of keeping ahead of the sheriff at all times, through our own management ability."

"Exactly," said Gibbs.

"Gibbs is in a bigger field than he may imagine," said the controller, "for having been in on so much of the development work this past year, I know full well what we have let ourselves in for. I suppose though, the work we have been doing along lines of organization, is the answer."

"You've said something there," said Purdy. "I've been through all that this year. Living with this business is as much a part of our organization work, as the work of designing and building is, and developing the methods for its personnel to use."

"It's this task of living this business life satisfactorily to all concerned that I am thinking about particularly," said Gibbs, "and I feel that we have the talent here to find out how to do it."

"My work as controller this year has made me wonder," said Lewis, "where we are going to get our big men from in the future, to direct our industrial activities. I must confess that I sometimes back away from my own job and view it with holy horror."

"I can second that statement," said Scott, "for my job as production control supervisor is somewhat analogous to that of Lewis, and I often go home wondering whether I am going to make a go of it or not. I have also thought about this matter of our future industrial leaders; the men who are to take the places of those who are in the harness in industry today."

"You two have opened up an avenue of approach to what I have in mind, in a way that is almost uncanny," said Gibbs, "and I don't know of two better men to place our real needs before us, because between you, there is little about this business that you don't get into. Dig in further, and let's see what comes of it."

"In all seriousness," said Lewis, "I wonder if we aren't making jobs bigger than the men who try for them? The running of our government is a man-killing job. Wilson cracked under the strain, and Harding has protested because of the terrific load a president has to carry. Taft only lasted one term. It took supermen like Roosevelt and Lloyd-George to get results, in their respective fields."

[1] Preceding articles in this series were published in *Management Engineering*, January 1923, p. 9; February, p. 93; March, p. 157; April, p. 245; May, p. 321; June, p. 409; and in MANAGEMENT AND ADMINISTRATON for July, p. 59.

"In industry," he continued, "we have seen an evolution during the past 20 years, which the student can view only with alarm. The unsettled condition abroad, our increased taxation and tax complications, the differences in the laws of the various states affecting corporations, tariff and immigration complexities, general pull and haul between political groups, unwillingness on the part of many really to work, lack of the service which used to be the order of things, increased conflict between workers and employers, labor shortage in busy times, wasteful use of our natural resources, freight embargoes, too much radicalism, and construing license for liberty, make the task of getting an average profit over a period of years a matter of biting your finger nails, tearing your hair, and ending up as a fit subject for the bughouse."

"Some pessimist, I'll say!" exclaimed Curtis.

"Yet there is, no doubt, a lot in what Lewis says," was the quiet and thoughtful statement of Gibbs. "I have been on this firing line as general manager for a long time and each year the task seems increasingly difficult. I sometimes wonder if nerve and sinew can hold up under the strains they are subjected to in modern business. We know the number of business wrecks and their reasons yearly, but how about the human wrecks caused by an intense activity which gets the best of us in time? On the other hand, the American is nothing if not resourceful, he is a doer, a 'go-getter,' and it's there our hope of the future rests.

"In other words, while admitting all that has been said, I feel that it is all a *challenge to American ingenuity* and I don't care what line a man may be in, the one who keeps his teeth in the longest, *and to the last tooth* is the one who wins out."

"Yet, Mr. Gibbs," said Scott, "just how is this ingenuity to make us a race of super-industrialists? Our knowledge is now so vast compared to what it was 20 to 50 years ago, with advances in scientific lines being made every day, that we are fast getting further and further away from the ability to cover a broad field, and are making it increasingly necessary for one to specialize in a given direction. The whole system of industry may change within a generation.

"My father was a foundry superintendent in the days which have passed. He bought his own pig and scrap irons, coke, sands, lumber, and supplies; hired and fired his men; looked after his own melting; kept his own storerooms; set piece rates; kept costs; analyzed his irons by fracture, coke by breaking a piece in bits, sand by the feel of it; said what castings should be sold for; and altogether he was master of all he surveyed. As one thing after another was taken away from him, he grew increasingly indignant, never did get over it, and predicted that industry was headed straight for hell, when the man that knew couldn't run things. Today what have we? Purchasing agents, physical and chemical laboratories, storekeepers, inspectors, cost accountants, industrial physicians and nurses, estimators, rate-setters, personnel men to hire and fire, mechanical betterment men, plant engineers, tool draftsmen, master mechanics, controllers, production supervisors, research men, statistical sharks and all kinds of clerks and the like.

"Now the point is," Scott wound up, "where are we headed for? What will be the conditions 20 years from now? What kind of men will we have to run things and where will we get 'em? The great tendency is for the younger generation to get into 'white collar' lines even though the pay is less. How about this point? Where are our workers coming from—our skilled and semiskilled men? And how about shortages and cockiness of unskilled labor in busy times? How will we get the rough work done cheaply? And most important of all, perhaps, where are our future foremen coming from, and our superintendents?"

"I'll bite," said Gibbs, "by asking how, what, why, and when? How about you, O'Grady? That mournful look of yours leads me to feel that the comments of Lewis and Scott have registered."

"They have," said O'Grady, "for to tell the truth I've long thought about the same things, until I am weary from the mental gymnastics. I agree with Napoleon who said: '. . . men are nothing, it's the man who is everything.' In technical and scientific development and research, we have forged ahead by leaps and bounds, but from the standpoint of our moral, ethical, and economic development, our progress, by comparison, has been slow indeed."

"And the answer?" asked Gibbs.

"Search me!" was the reply of O'Grady.

"But men, we must find the answer, or we'll be out of jobs!" said Gibbs. "This company must go on, and will go on, and in light of what has been accomplished this year, we're going to be with it to the finish. Administering the affairs is up to us and we must find ways to do it better than we have in the past."

"If I recollect correctly, Mr. Gibbs," said Curtis, "you stated at one of our early meetings, that you felt one man could rule the world, if it was properly organized."

"Yes, I remember that reply," stated Gibbs, "and I am convinced that I was right. All the great successes that history records, tend to prove it.

"I believe I said once," continued Gibbs, "in one of our meetings, that management was but *the wise use of co-ordinated knowledge*. We must know, and know that we know, and then build what we know into a completed whole, using what we have co-ordinated, wisely and well."

"That means, I take it, that we must post ourselves on everything pertinent to our business," said Curtis.

"Post ourselves hell!" exclaimed O'Grady. "That's another of the problems confronting executives today. The books on technical, commercial, and economic subjects are now so many—more of them published every day, not counting all the good articles every month or every week in the magazines—that if a man should attempt to catch up with the procession, not speaking of getting ahead of it, he would soon be in the fix of the guy who is the hero of the movies such as —'What Women Want' and 'Why Wives Leave Home'!"

The outburst brought a general laugh, and then Gibbs said quietly, "Well, O'Grady, there may be something in what you say, but nevertheless our task is to co-ordinate the valuable knowledge in these same books and articles and use it to our advantage, and the more difficult our tasks become, the harder we must work to keep posted."

"But we can't all do the co-ordinating, can we, boss," asked O'Grady.

"Perhaps not," replied Gibbs, "but we must work together as a group much more efficiently in the future than in the past—that's why this matter of administration is so important. As I see it, the biggest thing in industry today is *management*, of which administration and execution are parts. Administration asks *what* will you do; *how, when,* and *why?* Once decisions have been reached, execution steps in and carries out the policy, or plan or method. Therefore anything having a bearing on reaching those decisions is most important, for wrong conclusions based on faulty reasoning due to using false information or incorrect data or misleading statements, can raise more hell in business than anything else I know of.

"If we are going to be *real* managers, and put to work our abilities *both* as *executives* and *administrators*, we must substitute facts and figures, for 'I think so,' opinions, and unsupported statements. I remember reading a saying of Professor Lounsbury of Yale to this effect: 'The longer I teach the more I am impressed with the infinite capacity of the human mind to resist the introduction of knowledge.' Now what is knowledge but recorded experience, logical deductions, facts which can be demonstrated, provable evidence, accurate statement of happenings, and the like?"

"Help! I'm in over my head," said O'Grady, "and more of it isn't going to show me how to be a better manager."

"Well, what I intended to lead up to, O'Grady," said Gibbs, "was that this Professor Lounsbury was right, to the extent that humans tend to resist unsupported contentions, information not based on definite proof, which usually travel under the guise of knowledge. Slam $2 + 2 = 4$ at a man and he can by no process of the imagination get 3 or 5 out of it, can he?"

"No," answered O'Grady.

"Now take the case of the $30,000 punch press you recently had us buy. Did we buy it because you *thought* it was a good machine?" asked Gibbs.

"Certainly not," was O'Grady's rejoinder.

"Did you recommend it because you had some hazy half-baked idea it would save us money?" asked Gibbs.

"I did not," stated O'Grady. "I studied that matter from all sides. I saw one at work in another shop. I figured what kind of work it would do for us, how much of it there was to do, the cost the way we had been working, the cost under the new way, and I satisfied myself it would return its price in $2\frac{1}{2}$ years."

"Yes, and then *we* went to work," said Gibbs, "saw that real specifications were prepared, got the best price and terms possible after a lot of negotiations, wrote around to a number of [illegible] got their responses, checked *you* up with the [illegible] and then bought."

"And the machine's paying for itself [illegible]," said O'Grady.

"All right, O'Grady," said Gibbs, "*what was that but getting facts, [illegible] them, [illegible] them wisely?*"

"I get you," said O'Grady.

"Should the process be any different when it comes to borrowing money, telling you how much to buy of a certain thing, giving our sales force an estimate of the sales needed, determining the margin of stocks to carry, or other things?" asked Gibbs.

"Not a bit," answered O'Grady.

"Then as I see it," said Gibbs, "the question of where our big men are coming from, meeting the modern complexities, keeping up with the evolution towards greater specialization, and posting ourselves as to current advances, gets back to three things:

1. Getting what we know are facts.
2. Putting them together properly so that unrelated things have a real meaning.
3. Training men in the proper and prompt use of this composite information.

"If I see things correctly that spells 'organization.' The arrangement of the planets is an organized whole; so is nature, the human body, modern society; and so must be the conduct of modern industry, and *any* plant in it—ours for instance. You can't get away from it: *Management is the wise use of co-ordinated knowledge.*"

"You have given us all a new slant this year on this question of administering our business," said Lewis, "and I see my own work as controller in an entirely new light. I must confess, though, that the 'how' of it all is not so clear."

"Well if I recollect correctly," said Gibbs, "our modest purchasing agent helped us materially on the mechanisms of organization, when we were holding meetings on that subject, and perhaps we can get a few words from him on the matter of industrial administration."

"I am afraid the best I can do is to give you some theory," said Cook. "Perhaps it will start the discussion for you. As I see this matter of the responsibility of a manager, who is both administrator and executive, I would put it in these words:

1. He must develop his own initiative, and go further than mere directing. He should guide, counsel, co-ordinate, supervise—using the help of others for well-defined purposes, which when carried out, will contribute to the progress of the whole business.
2. He must develop initiative in others, so that delegated work which he passes on to them, may be handled intelligently to support well chosen policies.
3. He must avoid tendencies that would make him only as big as his own personality, so that by co-ordinating the work of himself and others, he may become as large as the composite of his entire organization.

"You will notice that I stressed initiative, but I did so purposely, as I want to define a manager in terms of various degrees of initiatives. I would classify managers in about four grades as follows:

1. The one who conceives things to be done, without being told about them, and delegates the work to others to do.
2. The one who conceives things to be done without being told about them, and who has to do the work himself because of his fear of turning it over to others, or because he has no capable assistants.
3. The one who conceives of things to be done, after being told about them, and who then delegates to others the work to be done.
4. The one who conceives of things to be done, after being told about them, and who then does the work himself.

"Now, let me give you an idea as to the functions of a manager," Cook went on. He got up, walked over to Gibbs's bookshelves, and pulled down a volume. "Here is what Herbert N. Casson says:

The business of a manager is to manage. He is to co-ordinate the various departments of his company. He must secure team-play and enthusiasm. He must handle the invariable human-nature problem. He must administer justice. He is a leader, a judge, a general, a builder. That is what a manager is.

Many a man thinks he is a manager when he is nothing but a laborer-in-chief. He is nothing but a sort of head-worker who possesses authority over the other workers.

A real manager, on the contrary, is a man who directs, instructs, creates, organizes. So far as possible, he does nothing himself which he can get some one else to do. His business is not to do work but to get work done.

A real manager gets his staff trained. He fits people to their jobs, he studies his people, and he studies their work. Often he goes away for an entire day and just thinks—thinks about the whole problem and plans for the future.

A real manager knows the meaning of organization. He knows that he is a head, and not a pair of hands or legs. He is not fussy. He does not mess with details, but from morning until night he concentrates upon just one thing—*Results*."

"I guess that gives us a design and specification of a manager," said the chief engineer, Curtis. "I wonder if there is one of us here who really measures up to them? I know I don't and I am not afraid to say so. Let's have some more, Cook, you're going strong."

"Yes, there is one thing more," said Cook, "that ties in with what I have just outlined. A manager must be a *master* of detail and not its *slave*." He got up again, and pulled down another of Gibbs's array of books. "This is what E. B. Gowin says in his book 'The Executive and His Control of Men.'

Napoleon in his failure to relieve himself of details by building up an adequate staff, is an illustrious instance of this truth. During his early years, he made up for this by his remarkable activity, but by the time of the last German campaign, the intellect, once sweeping and vigorous enough to compass all details, had begun to falter. Napoleon's defeat at Leipsig was mainly due to his neglect of details, which here seems to have been left largely to subordinates. Hitherto he had saved them all the thinking, and now in the emergency they possessed no directive capacity, but looked to him to arrange everything. Such business Napoleons are legion, and Leipsigs in consequence are being lost every day."

It was plain to be seen that the various angles presented by Cook had made a deep impression, especially on Phelps, who had jumped to his feet and was pacing the floor. Stopping before Cook he said: "Cook, do you know what you are developing? Do you know that you have described 'man-building' as I have never heard it stated? Don't you see that you are putting the making of men before the making of money? Don't you see that you are telling us that *man* is the real investment in our business, and that as we develop men we strengthen our organization, and conversely as we develop our organization we develop men? You're coming to me, man, both feet, and I say to all of you, that when the time comes that the things we have discussed today are developed in the light of what Cook has propounded, there is a new era in sight for the Benson Machine and Construction Company."

"I didn't know we had an orator in our midst, Gibbs," said O'Grady.

"Oratory nothing!" retorted Phelps. "The human side of business is my side, and I know that all of this made a deep impression on me, but wherein was I wrong, O'Grady?"

"In no particular, in fact I am beginning to see my way out," answered O'Grady.

"I am sure Cook has our thanks," said Gibbs, "for I for one can see where he has touched on some of the real elements in administration. It all means this, *make men and we will make money, for we can't make money without men.*"

"Look here!" said O'Grady. "If you won't all think I have a 'brainstorm' I'd like to outline what is running through my mind, although its hellishly radical. You remember, Gibbs, what led up to our making Scott here, our production control supervisor, co-ordinate in authority with Lewis, our controller?"

"No, I can't say that I do," answered Gibbs.

"Well you know that day," said O'Grady, "when we were having a conference on 'controlling the production' I sent for you to give us your slant on the subject and you told us that production control had four angles—purchasing, sales, manufacturing, and financial?"

"Yes, I recollect now that you mention it," answered Gibbs.

"Well, I have been doing a lot of thinking since then," said O'Grady, "and as a result, I believe I see a future development in industry that is of major importance, one that will exert a most beneficial influence on this matter of administration."

"All right; let's hear it," said Gibbs.

"Ever since I have been in industry," said O'Grady, "I have watched this evolution that Scott mentioned, from the bottom up, until today we have our production control supervisor on a par with our controller. Back in the old days each foreman and superintendent did his own planning; then we saw the development of the 'job-ahead' plan. This was followed by the organization of planning departments under superintendents and foremen in some cases. Later such activities were centralized and expanded, and put under a works manager or general superintendent, made co-ordinate in authority with the operating heads. We have stepped this function up a grade and it is now under the general manager.

"Now then, Lewis, hasn't there been about the same evolution with reference to our modern controllerships, from the top downward?" asked O'Grady.

"Yes, there has been a steady but sure development as our industrial activities become more complex and extensive, and in the direction you state, so that today a controller is subordinate to the executive management, while the treasurer is subordinate to the corporate management, whereas in the old days the treasurer was corporate officer, auditor, cashier, accounting and cost clerk, statistical man, and in many cases the company secretary also. More and more the controller is the managerial brains on matters of income and outgo, co-ordinating the economic and financial matters, the treasurer looking after corporate affairs more and more, contracts, credits, banking, meetings, statements, tax returns, and the like. Why do you ask, O'Grady?"

"For the reason," replied O'Grady, "that I wonder if the time is far distant when this 'from the bottom-up' process and 'from the-top-down' process, will meet and merge, giving us *one* function of control, covering both production and financial activities. They are both interested in the *same* things, as I see it, one from the physical angle, and the other the money side."

"Hold it! Hold it! You've struck something," said Gibbs. "Let me have the minutes of that 'controlling the production' meeting you mentioned, O'Grady."

After they were brought to him, Gibbs found what he wanted, and read to the group these words of his, expressing his views as regards what production control should be:

> In other words men, controlling production is not alone the job of the foremen in the shops. It is as much the job of the divisional superintendents, of O'Grady here, as factory superintendent, of the purchasing agent, sales manager, personnel director, controller, and yours truly as general manager. It is even the job of the directors, in shaping the major policies of the company. As I see it, it is a big thing you have got hold of here that is worthy of the best efforts you can give it, and it ought to be; and it should be the special care of one department, which can well be the co-ordinating machinery of the entire business. It is a big part of the answer to the problem we have got to solve—getting out maximum production, at the right times, at minimum cost.

"With slight changes in wording," said Lewis, "that could well describe what the controllership of this business should be."

"Which means, I take it, Lewis," said Gibbs, "that you are not out of sympathy with what O'Grady suggested?"

"Not at all," said Lewis, "and while the idea is a startling one at first consideration, there is no question but that co-ordination and control are two of the biggest elements in modern business, and what would be more natural than to merge the work of the controller and the production control supervisor, whose duties have to do with the same ends, putting this merged function under the general manager [illegible] business [illegible] development [illegible]

"Well, the [illegible] time," said Gibbs, [illegible] co-ordination and control [illegible] serves stores and [illegible] controllership and the [illegible] their separate and respective [illegible] and distributing all [illegible] tion, advice, and the [illegible] solar plexus. In [illegible] is called 'the abdominal brain.' [illegible] abdominal brain can function [illegible] while the cerebrum *cannot* [illegible] plexus. This should also be so in [illegible] business. An executive cannot [illegible] troller and a production control function [illegible] industrial solar plexus operating efficiently [illegible] should be able to function without [illegible] around."

"So he could go fishing, I suppose," said O'Grady.

"Golfing would be more like it," said Lewis, who knew his chief's weakness for the golf course.

"Why not?" was the comeback of Gibbs. "You know as well as I do, that one of the curses of modern management is 'executive fatigue.' You advocate a fatigue allowance for the worker, who is relatively in usually a well-lighted, well-ventilated shop, while we, perhaps because we don't know any better, smoke all the time; sit hunched over our desks too long, in offices either badly ventilated or not ventilated at all; busy all the time on mental work of some sort; take little or no exercise; and then wonder why we get bilious at times. Why not a fatigue allowance for executives?"

"What are you looking for, a lecture or sympathy?" asked Curtis with a laugh.

"Well, it's a point just the same," said Gibbs, "and one which we should consider in our plans for administering our business in better shape. Some golf or tennis, an occasional day off, a little exercise each day and proper diet, will enable all of us to do better work. At any rate any aids or mechanisms that we can use in our everyday work, that will reduce this 'executive fatigue' should be adopted."

"We're all with you there, Gibbs," said Lewis. "You can start the executive fatigue allowance whenever you want to. But what about this idea of one brain actively in control and co-ordination of the business as a whole?"

"I believe we can all accept the plan in principle," said Gibbs, "and my recommendation would be that Lewis and Scott who are the ones chiefly concerned with any such development, act as a committee to go into this further, work out the 'bugs' and report back later."

To this all agreed.

"Isn't it just as important, Mr. Gibbs, to have a well organized staff, subordinate to the general manager, as it is to have a co-ordination function?" asked Cook.

"Well, we talked staff in our organization meetings," said Gibbs, "and I've been waiting to see whether it would be brought into this discussion. What's on your mind, Cook?"

"Any business needs constant analysis and study," answered Cook. "It needs a counseling mechanism, a standard practice bureau. I'm strong for a centralized activity on control and co-ordination, such as we have just discussed, but we need investigation, formulation, discussion, and acceptance of new things, improvements and the like. The 'operation standards division,' under which are the mechanical betterment and rate-setting work, is Mr. O'Grady's plant staff. Why not a management staff function?"

"In other words," said Gibbs, who was a firm believer that the human body was a good model to pattern after, "you would give us what are the senses in the bodily organization, the experts and counselors called sight, touch, smell, taste, and hearing?"

"Exactly," answered Cook. "I would say that a man does staff work who asks regarding any point: 'Why are we doing a thing this way?' 'Is there a better way to do it?' 'What is this better way?' 'How can we work out this better way?' Further I would define staff as:

> That function in a business which is advisory, analytical, critical, suggestive, and investigative in character, which studies the business at all points, at any time, and which outlines, or formulates, what the standard practice should be, for acceptance, rejection, or modification by the management.

From this brief description of staff work you can see that it could fill a real need in this business."

"All right, Cook," said Gibbs, "you're delegated to work up the details and present a complete staff plan at a later meeting, the same as Lewis and Scott on this master industrial control function."

"We were talking a while back," said Curtis, "of making wise use of co-ordinated knowledge. The points I want to raise are—What knowledge will be co-ordinate? How will we co-ordinate it?"

"Have you given any thought to those phases, Lewis?" asked Gibbs.

"A great deal," replied Lewis. "My answer to the first point is that a master industrial control function, plus staff activity, can jointly develop the kind and amount of information and facts which would make up the required knowledge. My answer to the second question is—*managerial charts.* As you may know, we recently organized an economic research department which is making a study of wastes, cycles, unemployment, wage rise and fall, cost of living, and the like. I reorganized our statistical department and we are gathering very valuable facts and figures on a variety of subjects.

"The next step should be a chart room, and chart books, which would graphically portray for our executives and directors, our co-ordinated knowledge, which would help materially in determining policies and reaching major decisions. In time, we could have in *one* room and in books in desks of executives, a picture of our business *as a whole*, from which we could study standards and performance as to purchasing, selling, financial, engineering, and manufacturing. Relationships could be shown, which would greatly assist in charting our business course, and steering therefrom. I won't try to list here the various factors which would have charts, but I am certain that we can work up the kind which would co-ordinate all the pertinent facts and information."

"It all sounds good to me," said Gibbs, "and you had better report on this matter in fairly complete form, at a later meeting. On second thought, I think you and Scott and Cook had better work as a sub-committee on all these matters we have discussed, as in this way a better job will be made of things, than if there are three separate reports on master industrial control, staff organization, and managerial charts."

"Well, all I can say," said O'Grady, "is that we're going to see a higher degree of administration in this business. I didn't know where we were at, on the start, but after taking part in these discussions, and absorbing what has been said, I'm convinced we are going to be bigger and better men, and I'm also convinced *that we will make our men to meet the new conditions as fast as they change.* I can't see where anything has been overlooked."

"I have one thing more," said Gibbs, "and it is the matter of conferences, which I want this sub-committee to plan on including as a regular thing. All this year we have held conferences and as I look back, I have noticed a number of benefits from them. We have brought subordinates in close touch with executives, and as a result both are better acquainted. More than one brain has been focused on a given problem. We gave subordinates, even workmen, a chance to air their views, and advance their pet theories. The management has a much better line on the judgment and ability of its executives. We have placed line men in the position of staff advisors for short periods. Each man has had an opportunity to form a real conception of the problems of others, which is conducive to co-operation and mutual understanding. An organization spirit has been fostered and developed. The law of suggestion, due to the exchange of viewpoints, has given us much more than if we had worked with but one individual at a time. Finally we have established a personal relationship, which gives promise of making us the best composite group of its kind in the country. If all of this isn't man-building, then I don't know what I'm talking about. Mind you, men, these are really *by-products,* as these conferences were for the sole purpose of developing good working methods for profitable management. Is it any wonder, then, that I'm heartily in favor of having a regular and systematic conference program, especially in view of the fact that they have in themselves, been indirectly responsible for a higher degree of administration than we had in 1922?"

"At any rate," Gibbs concluded, "we've done some real work this year, and the results reflect it to the satisfaction of our directors. What we have been talking of today will make getting results a *permanent matter with us.* It will broaden and strengthen us as managers, enable us to train new men and keep us abreast of progress despite growing complexities. We will prove to our workers, to our directors, to our trade and to our bankers, that *Efficient Management is but the Wise Use of Co-ordinated Knowledge.*"

The Next Half-Century of Industry

A Forecast Through the Sesqui-Centennial

By JOHN PRICE JACKSON

Executive Director, Sesqui-Centennial Exposition

EVENTS which have transpired since the Panama Pacific International Exposition held in San Francisco in 1915, the last great World's Fair, make deeply significant the approaching celebration of the Sesqui-Centennial of American Independence, an international exhibition to be held in Philadelphia April 30 to November 13, 1926.

The Exposition has already received the official approval of President Harding and Congress, and the president has been authorized to address communications to all state and foreign governments asking them to participate. The governor and legislature of Pennsylvania have passed a resolution of endorsement and and have pledged ample financial aid toward the cost of the Exhibition. The mayor and City Council of Philadelphia have given official approval, backed by a contribution of $5,000,000; and hundreds of leading business and professional men, manufacturers, financiers, and many prominent women have enroled among the volunteer workers on committees which will co-operate in the activities of the experienced staff now busy executing the host of details already decided upon.

The site of the Exposition will be the Fairmount Park-Parkway area, comprising about 600 acres of one of the most beautiful city parks in the world, readily accessible from all parts of Philadelphia, finely adapted to the purpose on account of layout, scenic, lighting, and transportation possibilities, the permanent location of several of the city's great museum, public assembly, and library buildings, and the site of the famous Centennial Exposition of 1876.

Fundamentally, the scope and purpose of the Exposition will be:

"To fittingly celebrate the 150th anniversary of the Independence of the United States of America in the place of its birth.

"To advance the cause of peaceful understanding and co-operation among all nations.

"To appraise the social and material progress during the next 50 years by reviewing that of the past half century.

"To tell and illustrate the story of how everyone's day's work fits into the world's work in the humanities, education, literature, art, science, industry, transportation, and communication."

Present plans call for a grouping of the Exposition under the following main heads:

1. The humanities, such as education, medicine, surgery, sanitation, literature, printing and bookbinding, history, government, etc.
2. Social section. State and foreign government buildings. Open air theater seating 150,000 people.
3. The fine arts.
4. Amusements, ceremonies, music, customs and recreations of all nations.
5. Shipping. Also railway and airplane transportation.
6. Industry, including the semi-fine arts, mining, and agriculture.

The industrial division will be grouped into three main sections:

1. Communication. The telephone, telegraph, wireless, and also the phonograph, and the making and reproduction of motion-pictures.
2. Semi fine arts. These cover such industries as the textiles, potteries, jewelry, etc.
3. Utilitarian production. Manufacturing in all its branches, natural resources and their extraction, and agriculture.

The aim throughout the industrial exposition will be to show the advance made in production methods during the last five decades, or since the Centennial, as a means of encouraging even greater relative progress during the next half century. The ideas to be developed are:

1. Educational and inspirational.
2. Increased trade.
3. Artisanry and economics.
4. Economic teachings.
5. Good conditions in the workplace.
6. Sound relationships.
7. Conservation of resources.

The educational and inspirational element will be obtained in part by contrasts showing the developments made since 1876 in the machines and appliances of industry—the original Corliss engine beside the vastly more powerful modern steam turbine; the locomotive of 1876 and the electric locomotive of 1926; the hand plow of a half century ago and the farm tractor of today.

The stimulus to trade will be fostered by the contributions to the exhibits from manufacturers all over the world. In each case the finest and most utilitarian articles will be shown and industrial executives will have assembled for their careful investigation the world's most useful products. In turn, they can furnish those exhibits of worth-while goods which are most merchantable at home and abroad. Thus a mutual impulse to domestic and foreign trade will result, and both maker and buyer will reap economic benefit for many years, having met on common ground.

Artisanry and economic teachings will receive very decided treatment. The earnest endeavor will be made to stimulate every man's pride in the products of his own labor, to arouse his respect and admiration for the work of others, and to give repeated practical demonstrations of the fitting in of each occupation with all others in an industry. The manufacturer of shoes, for instance, will, perhaps, unite with the tanner, the farmer, and others in producing an exhibit covering the whole field of the leather industry. By means of actual specimens, models, or pictures the cattle will be shown on the ranch or farm, and the overhead with which a farmer has to contend will be portrayed. The preparation and tanning of the hide, the transportation involved, processes of making the shoes, and methods of wholesale and retail distribution all will be demonstrated in proper sequence. Workers from every section of the country will thus be able to see their individual contributions to the finished article and feel themselves worthy members of a great co-operating body of men and women.

Other Industrial Features

Good conditions in the workplace will receive careful attention. From all points at home and abroad the best and most workable methods and appliances will be gathered and placed in orderly relation to each other. This does not mean that a miscellaneous collection of safety and sanitary devices will be put on display. Careful selection of exhibits is intended to bring about a unified and typical grouping of ideas. As a result, the manager of an industrial plant can make a comprehensive investigation of the best that the world offers, with the object of finding out what will be most practical to apply to his individual shop, both in the way of methods and devices.

Sound relationships between capital and labor are of paramount importance and the Sesqui-Centennial will endeavor to show the best and most successful methods of achieving fundamental and practical understandings between those who finance and manage an enterprise and those who directly turn out the product. Of necessity this must be a strictly impartial undertaking. Loyalty of the employer to the trust reposed in him by his workers, faithfulness of the worker to those who direct his activities, and the living up of both to American ideals—principles of equality of opportunity, as set forth 150 years ago in the Declaration of Independence—form one of the most serious objects of the Exposition.

In calling attention to the conservation of natural resources the aim will be to educate Americans in regard to the vastness of the assets possessed by the nation. Mining, water-power development, and agriculture will fill important places in the Exhibition. The means necessary to prevent waste and exhaustion of the products of mines and forests will be impressively portrayed.

The industrial exhibits will be grouped about ideas in order to achieve the maximum of practical benefits from the Exposition. Each committee for an individual field of industry will be made up of representatives of all the large associations concerned with that industry. The committee will be assigned certain space and will be asked to work out, first, a main exhibit that will show in a comprehensive and accurate way the materials and methods used to produce the leading article or articles in its field. After that, typical detail exhibits of the various branches of the industry will be arranged for, but on a selective basis to include only the best and really important elements. The mere fact that a product is on the market will not win it a place among the exhibits. It must possess merits that make it stand out as of real value.

It seems most feasible to erect and allot a certain group of buildings to industry and assign space in them to the different branches. Each division can then best prepare its exhibits to harmonize well with the general central theme. Major subjects of general interest to all industries, such as safety, good working conditions, economic teachings, and loyal relationships, undoubtedly will group together in separate sections. In the section devoted to industrial safety, health, and sanitation the medical profession will find an important opportunity to display advances in medicine and surgery. Another large building probably will be assigned to those crafts requiring skilled artisanry, such as textiles, potteries, and jewelry, which are classed as semi-fine arts. Vocational education, of interest to industrial executives, can be given a large section in the group of buildings devoted to education as one of the humanities.

Probably the opportunity to negotiate sales orders will be given to manufacturers. This is in line with one of the objects of the Exposition, that of promoting domestic and foreign commerce. Many articles will even be made and sold on the grounds if their manufacture harmonizes with the educational and economic teachings of the industrial division.

Practical Exhibits

All exhibits will be thoroughly practical to the purpose and every endeavor will be made to present them true to life. Working models, actual life-size machines, appliances and articles, actual processes, moving-pictures, paintings, photographs, charts, and every other feasible means of making the Exposition clear and complete throughout will be employed. The negotiation of sales will be facilitated for manufacturers and distributors where such procedure will not interfere with the orderly and dignified handling of the Exposition. The advertising element, through actual exhibits is, of course, very prominent.

The busy men and women who are unsparing of time and effort to make the Exposition an event of world-wide importance believe that they have had assigned to them by industry a great trust. The Liberty Bell once proclaimed the principle of independence from tyranny and the essential equality of opportunity due all men; the Sesqui-Centennial Association feels that an epoch has been reached when, in the words of the official slogan for the Exposition, it is necessary to —"Ring it Again!"

Report on Anthracite Coal Industry

Publication of Costs and Better Management Advocated

THE United States Coal Commission has submitted its separate report on the anthracite industry, leaving some points, however, to be discussed in its final report, which is due before September 22 of this year. The questions considered in the Anthracite Report are: Whether a reasonable return on investment can be paid to owners and operators; decent living conditions, and an adequate wage based on American standards furnished to the mine workers, a proper return made to the railroads and dealers; and whether coal can be supplied at lower prices than now charged, and a constant flow assured from mine to consumer.

The recommendations of the Commission on some dozen points which have to do with the control and management of the industry are given in the following excerpts from the report.

Ownership or Regulation

The Commission does not recommend the abolition of existing property rights, however much might be said for the view that mineral deposits should have been held from the beginning as national rather than individual property. The Commission does not recommend government ownership either by purchase at present value or by expropriation. It does, however, hold the view that a limited natural monopoly like anthracite, held by a relatively small number of individuals, estates, and companies, and supplying a necessity of life for millions of our people, can not continue to be treated as if it were not affected by a public interest.

Coal is quite as much a public necessity as gas, street railway service, or any other service or commodity that has been brought under public regulation. There should be no secrets from the public in regard to mining costs, profits, salaries, wages, or corporate relations. Banks and insurance companies are privately managed because we find by experience that they can be managed more efficiently and economically on the principle of individual responsibility. But, like railroads, they are required to report to a public authority and they are subject to such regulation in the public interest as experience may show to be necessary and public opinion may from time to time approve. The guiding principle in such enterprises is no longer maximum profit to owners but maximum service to the public.

The time has certainly come to establish the same controlling idea in the anthracite coal industry. There is not as yet a sufficient basis in knowledge or experience to determine what form of control or regulation will ultimately be most advantageous. What is clear is that in the operation of coal mines, as in the operation of [illegible] phones, [illegible] [illegible] public interest [illegible] respected [illegible] [illegible] operators [illegible] Commission [illegible] [illegible] strongly [illegible] of the industry and that the public [illegible] adequately safeguarded by the [illegible] government authority [illegible] power to [illegible] operating reports, to prescribe uniform [illegible] cost accounting [illegible] to determine [illegible] which coal may be shipped in interstate commerce.

The President of the United States should be authorized by act of Congress to declare that a national emergency exists whenever through failure of operators and miners in the anthracite industry to agree upon the terms of employment or for any other reason there is a suspension of mining operations, seriously interrupting the normal supply of anthracite coal in interstate commerce; and to take over the operation of the mines and the transportation and distribution and marketing of the product, with full power to determine the wages to be paid to mine workers, the prices at which the coal shall be sold and, subject to court review, the compensation to be paid to lessors and mine-owners.

Publicity of Accounts

Regardless of the final verdict as to reasonableness of profits the Commission is convinced that publicity of costs, prices and profits must be provided to protect the interest of the public. At present the current reports published by the federal government deal only with statistics of labor, production, and stocks of coal and even these are returned voluntarily and there is no power to go behind the figures submitted. Most of the companies file these voluntary reports promptly and cheerfully, but certain ones do not. During the crisis of 1922-1923, the reports on coal storage issued by the Federal Fuel Distributor did not contain the all important information on stocks of anthracite held by the producers because the Hudson Coal Company was unwilling to furnish its share of the information. The Commission therefore recommends legislation providing for regular accounting reports to be rendered by all companies whose product moves in interstate commerce, and further recommends that the agency to which the reports are rendered shall have the power to prescribe the form of accounts. The opportunities for inflating figures of costs are so numerous and the questions as to how investment shall be reckoned are so unsettled that without such continuous publicity the Commission fears that the concentrated control of the anthracite industry may take indefensible profits.

It is found for example, that two of the largest companies carry no depreciation account, but charge certain outlays for replacement direct to operating costs. Without the most minute checking of each item it is impossible under this arrangement to be sure that items properly chargeable to capital account have not been included in current costs. The field accounts of this Commission report that some of the companies in earlier years charged off against current operations the entire costs of new plants, equipment, and development work, which good accounting practice would recognize as legitimate capital charges. This subject will be discussed in detail in the Commission's final report, since it concerns also the bituminous industry.

Better utilization of the anthracite that is mined is a problem in national economy in the solution of which anthracite consumer and anthracite operator must join. In terms of total annual output the supply is stationary; in terms of tons per capita it is declining.

Reduction in Number of Sizes

Improved practices in the use of anthracite as well as in its preparation that promise some relief relate to the sizing of anthracite and the disposition of the smaller sizes; better inspection of the coal as it leaves the breakers; use of substitutes and better fuel economy in household heating.

Simplified practice in sizing of anthracite is needed. Coal is now commonly sold in four domestic sizes—egg, stove, chestnut and pea; and three steam sizes—buckwheat, rice, and barley. To prepare these seven sizes and keep them separate in their journey from mine to destination adds to the cost. It adds to the cost of preparation, and it decreases the proportion of the domestic sizes through breakage in repeated crushing of the lumps. It adds to the cost of switching and handling at railroad terminals and tidewater piers. It adds to the cost of the retailer who must store and truck the several sizes separately.

Reducing the standard sizes from seven to four, as proposed from time to time and as already practiced in part by one of the large producers, would reduce costs and increase the amount of domestic coal available. It would facilitate wider use of the small sizes for heating.

The Commission therefore urges that the question of simplified sizing be considered at once, by a joint conference of producers, railroads, retailers, and chairmen of state and municipal fuel committees, and that the Bureau of Mines be consulted in determining the sizes to be produced, and in reporting on the relative heating values of the present and proposed sizes. The simplification is recommended in the interest of the public.

Complaints of poor quality of coal are a common feature on the recurring shortages of anthracite. The complaint is not confined to isolated carloads of "fireproof" coal shipped by "snowbird" operators. There is a widespread feeling that quality deteriorates during periods of scarcity and that much dirt, slate, and bone is passed on to the consumer. It is this feeling that has inspired bills providing for government inspection introduced both in Congress and in the legislatures of several states.

It is not possible to ascertain what per cent of coal shipped during the crisis of 1922-1923 carried an unreasonable amount of ash. It is known that many of the responsible shippers have not relaxed their standards of preparation. Those shippers have every reason to join with the public in support of some plan to protect the good name of their industry by guaranteeing the quality of the product.

The Commission therefore suggests to the anthracite producers that they join in an intercompany inspection service, which shall be empowered to prescribe standards, inspect and sample shipments, reject inferior coal, and certify if not guarantee, the quality of coal passed. Membership in the inspection service should be optional, but few producers could afford to stay aloof from such an association, when once established.

As a pledge of good faith to the public, the Commission suggests that the operators invite the United States Bureau of Mines to participate in the proposed inspection service both by technical advice in laying down standards of preparation and by detail of a fuel engineer to observe and check the work of inspection and grading.

Co-operative inspection is preferable to compulsory government inspection, because it can be inaugurated at small expense by consolidating the inspection forces already maintained by many of the companies and because it is in line with the idea that the responsibility for management should be thrown back upon the industry itself. If, however, this proposal is not accepted by the anthracite trade or should it not in practice effect the desired purpose, the Commission recommends that a federal law should be enacted for permissive grading and inspection.

Use of Anthracite Substitutes

To eke out the inadequate production of anthracite each year the waning supply must be supplemented by increased use of other fuel. In the anthracite-consuming territory proper, convenient substitutes are not generally carried by the retail trade. The nearest bituminous mines are a hundred miles farther away and therefore pay higher freight charges. Very few mines in the bituminous districts adjacent prepare their coal in the sizes convenient for household use. So ingrained is the habit of using anthracite that there is little effective competition with other fuels. They have not displaced anthracite; they have supplemented it. Competitive relations have tended to advance the price of substitutes quite as much as to depress the price of anthracite.

The most promising supplementary fuels are: small sizes of anthracite, used either in specially designed furnaces or in present furnaces either in the form of briquets or mixed with the larger sizes; carefully prepared bituminous coal of the kind commonly sold in the West and South; coke specially prepared for domestic use either in by-product ovens or by some process of low temperature carbonization. Manufactured gas or fuel oil may appeal to some householders but the prospect for producing either of them at prices that will be attractive is not reassuring. House-heating by electricity is not within the realm of practical affairs as is quite evident if the thermal efficiency of good house furnaces is compared with that of the generating station. It would take five times as much coal at the station to generate the current required as to generate the heat at home. Whatever may be possible in the far West where there is surplus water-power, the conditions in the anthracite-burning region are such that the current from any hydroelectric plant would cost perhaps three times as much as the coal used in the house furnace.

The engineers of the Commission are convinced that with sufficiently active demand the manufacture of briquets and of coke can be so improved as to yield increasingly large amounts of supplementary fuel. The problem is one of salesmanship, public education and intelligent choice by the consumer.

Building up the demand for substitute fuels is one form of insurance against combinations of labor or of capital and the consequent rising prices.

Excessive Hours of Labor

While a general 8-hr. day was established by the Agreement of 1916, there are still a considerable number of employees working 9 or more hours per day. A report covering 55 specified occupations was secured to develop the number of employees in these occupations working 9 hr. or over. The total is 907. Some companies, but not all, reported occupations in addition to the 55 included in the questionnaire and these have been grouped under miscellaneous. As most of the companies only reported on the classes covered in the questionnaire, and as reports from a few of the companies show other occupations having a day of 9 hr. or more, the figures given would probably show less than the total number of men actually working 9 hr. or more in the 148 collieries reported.

In the face of the principle of the 8-hr. day properly accepted in successive agreements since 1916, there can be no justification for the employment of a considerable number of men on shifts of 12 hr. or more.

Neither individuals nor aggregations have the right to make a contract and ignore its obligations, and collective bargaining implies collective keeping of the bargain. The best standards of general industrial practice imply continuous cultivation of good relations between the employer and his employees, by organized efforts to build up industrial good-will, and by the selection and training of foremen and other employees. Organized efforts to promote such contact would tend to correct the sad effects of contacts based chiefly on grievances, and, needless to say, this would weaken the forces making for strife by strengthening the normal co-operative motives. Industrial practice has demonstrated that the best results are to be obtained where executive responsibility for personnel and labor matters is concentrated in one responsible executive whose attention is devoted chiefly to them.

Americanization of Aliens

Persons, firms, and corporations, doing business under the protection of the laws of this land, owe it to be diligent in their efforts to educate and naturalize the aliens whom they employ and for whose presence here they have been in too many cases responsible. It appears that less than one-half of the 78,000 foreign-born miners have sought citizenship, notwithstanding 68,000 of them have been in this country over 10 years. A rebirth of the American idea is needed in the anthracite region, and great care should be exercised to differentiate on questions which may lead to a strike as to whether they are economic or political in their nature. The alien should be permitted to exercise every economic right of an American citizen, but no political right until through naturalization he assumes allegiance to this country.

In accordance with the agreement made between the anthracite operators and the United Mine Workers of America, a new contract is to be entered into in the light of the recommendations of the Commission.

There is no adequate provision for the consideration of specific disputes at the mine nor for insuring that all employers handle the question the same way. The union participates by its district representatives, but the employers have no corresponding agent to represent them in the early stages of the disputes. In this particular this industry is not abreast of other well-organized industries. The Conciliation Board has done valuable work since it was created, in 1903, but as the years have gone by it has lost some of its effectiveness, and partly through its own fault.

So many changes have taken place since 1903 that the agreement should provide for a joint committee to work out a restatement of the whole agreement in the terms of today, and this agreement should be specific enough to be the code by which all persons having anything to do with the settlement of grievances shall be bound.

The renewed agreements have too rigidly retained the practices and conditions of 1902 and have not had adequate flexibility. An industry which is necessarily constantly changing cannot tie itself inflexibly to conditions of 20 years ago without hampering the management and working injustice to miners. A second joint committee should be provided for in the next agreement and directed to make an engineering study of the elements of the job of mining anthracite coal, for the purpose of building up a scientific and more equitable base for rate-making. Until, however, such committee shall disclose fundamental facts which shall form a decidedly better basis, the old 1903 base should, of course, be retained, for however inequitable the basis of 1903 with its subsequent modifications is, it is better than no basis at all.

THE EDITORS' PAGE

The Measure of Management

Of all the factors making for business success—or failure—management is perhaps the most potent. If other conditions are reasonably favorable, good management will make a profit while bad management will almost surely incur a loss. And the amount of this profit or loss will ordinarily be in direct proportion to the ability of the management—so much so that the only generally recognized measure of management is found in the profit and loss statement.

But other conditions are not always "reasonably favorable." On the one hand they may be so bad that the best management cannot make a profit, or even avoid a loss. On the other hand they may be so exceptionally good that a management, poor or perhaps distinctly bad, will not bring about a loss, or even prevent a profit. And in the conduct of many important enterprises—as hospitals, schools, churches, and the various governmental activities—pecuniary profit does not enter in at all. In all such cases the financial statement gives no indication of the part played by management. Obviously something better must be found if we are to have any real and generally applicable means of determining its excellence.

It is to the discussion of this more effectual measure of management that Mr. Schlink, of the American Engineering Standards Committee, devotes himself in another column. The problem he considers is not only of vital importance but is also most interesting, for it involves the weighing of intangibles—always a difficult matter—in a new field.

Mr. Schlink is of the opinion that management is susceptible to scientific measurement. As he states it:

> Management is the product of measurable physical and psychic factors, and we are just as likely to find an underlying science and technique here as in any other field of modern research.

For the present, however, the attempt to measure management is confined to but a portion of the field. This is due to the diverse responsibilities involved in management. Two major divisions of these responsibilities may be made as follows:

1. Policy control, or the determination and planning of what is to be done.
2. Organization control, which involves the more or less efficient execution of these policies and plans.

From the operative standpoint it cannot be said that either of these two major functions of management is the more important. Good management necessarily calls for sound policies and well-laid plans. But the wisest of policies and the best of plans do not in themselves constitute good management. They are, as intimated, an essential part, but before good management is attained, they must be put into execution and this can only be done through organization control.

From the standpoint of measurement, however, these two functions of management are not so evenly balanced. To pass upon the validity of policies and the excellence of plans is manifestly far more difficult than to estimate the effectiveness of their execution. Moreover, in many cases the merits of policies and plans can only be decisively determined by results secured through the operative organization. Mr. Schlink, therefore, in common with all others interested in the problem of measuring management, taking up the simpler function first, confines his discussion to the measurement of organization control.

This does not in any way mean that the measurement of policy control will not be undertaken, but merely that the simpler problem of organization control will be considered first. As a matter of fact the problem here is of quite sufficient difficulty, and its solution is not yet clearly in sight. It is not revealed by Mr. Schlink's article, for in it he merely points out the road that must be followed if a solution is to be found. The whole effort is an important one and in the interests of good business should be carried to a practical conclusion as soon as it may be done.

Management in Steel

President Harding refused to accept as final the report of a committee of the Iron and Steel Institute made public a few weeks ago to the effect that because of the shortage of labor the elimination of the 12-hour shift in the steel industry is infeasible. Supported by manifest public opinion he asked the steel manufacturers for a pledge that as soon as conditions warranted they would abandon the long day.

That pledge has been given by Judge Gary and his associated directors of the American Iron and Steel Institute. Its wording is strong:

> . . . we are determined to exert every effort at our command to secure in the iron and steel industry of this country, a total abolition of the 12-hour day at the earliest time practicable.

The statement goes on to say that the change "will involve many adjustments, some of them complicated and difficult. . . ." All this is true, but the way to solve the problems and overcome the difficulties has already been pointed out in the engineers' report on "The Twelve-Hour Shift in Industry." That report declares that better management is required to operate on 8-hour than on 12-hour turns, and that the management must be of the best at and during the time of change to secure satisfactory economic results.

Therefore the pledge of the steel manufacturers to President Harding is an expression of a determination to improve the management of American steel plants.

* * * * *

The promise of the American Iron and Steel Institute apparently dooms the 12-hour day—"and none so poor to do him reverence." And now comes another welfare movement for public consideration—the 5-day week. As usually understood this gives the worker Saturday and Sunday of each week for himself.

Recently the Merchants' Association of New York sent out a questionnaire to a number of manufacturers who have the 5-day week, asking them to report their experience with the new plan. Some 40 replied:

Three reported that they had used it only as a summer plan and three only as a slack period plan. Among the 34 who had tried it out as a permanent all-year-round plan, 16 expressed themselves as well pleased with the results, 15 were strongly opposed to it, 2 were in favor of it only when operating on a weekly schedule of 48 hours or less, and one took a neutral attitude.

The reasons for and against the 5-day week are interesting. Among the advantages of the plan are enumerated the following:

1. The same output with less power.
2. Labor turnover reduced.
3. Absenteeism reduced.
4. A great improvement in the health, spirits, and morale of employees.
5. The relatively high starting and stopping losses of Saturday eliminated.
6. Better balanced production, as Saturday morning can be used for "catching up" in any department that has not reached its quota for the week.
7. All religious requirements met.

Those opposed to the plan suggest the following disadvantages:

1. Decreased production.
2. Increased overhead.
3. Mail is disarranged.
4. Shipments delayed—Saturday shipments carried over to Monday.
5. Employees contract habits of loafing, drinking, gambling, etc., during their idle Saturday hours.
6. Increased labor turnover due to the fact that employees have Saturday morning to look for new jobs.

The movement has not gone far enough to be fairly judged. The fact that it is gradually spreading is an indication in its favor.

Economics of Industry

INDUSTRY is quite modern, though we are apt to think of it as a hoary institution. The economic forces which brought it into being are still operating, though we lose sight of them amid brick walls and humming machinery. The principles whose application in manufacturing have so profoundly affected human life are still active, though we forget them in considering the variety and volume of the articles produced.

As a result of our great industrial development the standard of living in the United States is higher than ever before, and our country has progressed during the past two decades while most of the nations of Europe have retrogressed. Yet we do not always see the underlying reasons for our advancement.

Realizing all this Dean Kimball, from an intimate knowledge of industry and manufacturing, has written the story of the organization of modern industry. He has revealed anew the basic fundamentals which forced this great producing and distributing institution into being and fostered its growth. He has pointed out the far-reaching applications of the principles of "division of labor" and "transfer of skill" and the operation of the great law of "increasing productivity."

Much of the illustrative matter is new, enriching, and giving life to a subject too often considered as having little bearing upon everyday work.

Major executives will find in these papers a new, vital interpretation of the "why" of industry, so presented as to throw light on present-day problems and difficulties. Other executives will be helped to understand how industry came into being, and the great changes that have been made in human living. Office managers will get from these articles an understanding of one of the great developments now well under way in office operation, the introduction of mental labor-saving machinery. The great principles and laws which have been so successfully applied to saving effort, time, and material in connection with manual work have been found effective in thinking work.

All who read "The Organization of Modern Industry" will find in the fundamentals set forth a complete answer to much of the radical propaganda which seeks through legislation to change the impact and effect of economic forces. And in our steadily increasing standard of living, the result of industrial production, is the reply to those who declare America is too mechanistic.

MANAGEMENT AND ADMINISTRATION, therefore, urges that the fundamental economics of industry as presented in Dean Kimball's papers, be made a part of the working knowledge of every reader.

Simplification in Semi-Fine Arts Manufacture

SIMPLIFICATION has gone beyond the purely utilitarian stage. It is no longer confined merely to those branches of manufacturing which turn out articles made preeminently for their use-value. The most striking evidence of this widening of scope comes from the semi-fine arts field, and, strange to say, France has taken what is so far the most radical step. A government bureau must approve the designs of many classes of French jewelry before they are put on the market.

How far this action has resulted from actual present economic need, or how far from a forecast of what the wisest future policy should be, does not matter. The same objects will be achieved, namely, elimination of waste all along the line from producer to distributor, and a raising of artistic standards to a point where French jewelry probably will be the finest in the world.

American manufacturers would doubtless resent any government control of such a nature. But they are beginning to see the value of concerted action along lines of simplification through a very natural and efficient means, their trade associations. Makers of textiles have a committee at work to devise a practical method of setting standard designs for fabrics, which quite likely will establish standards for quality, sizes, texture, colors, and patterns.

This program, if successful, will undoubtedly influence jewelry and pottery manufacturers, and perhaps even furniture and clothing producers, to follow a similar plan. Any one or more of the usual objects of improved methods will be attained—reduction in costs, elimination of waste, lowering of prices, increase in volume of sales, and the like. Even more favorable will be the consequent raising of the American standard of living, in a degree proportionate to the national economic welfare, by educating the public to a keen appreciation of the best in artistic design, and the establishing of a reputation for American products as the masterpieces of the world.

How will this affect the real artist, the genius in creation, the successor to the old masters who developed design and craftsmanship to its present state? What effect will it have upon the impulse to desirable individuality both in the designer and in the purchaser? In the past the artist has been largely the exclusive monopoly of the one firm with which he was associated. Other less fortunate concerns made articles which were marketable to an undiscriminating public. Under associated stimulus the genius should find unlimited scope for his best work, and the products of his art will be available to all manufacturers. In addition, the purchaser will have at his command every facility to express his own individuality without recourse to articles which violate art in being "different."

A Business Shock-Absorber

AN important factor in the rapid increase in volume of insurance written for firms and corporations on the lives of their chief officers, for the safeguard of the business, is the positive stand taken in its behalf by the leading credit agencies. The president of one of the larger agencies asserts that beyond doubt the taking of business insurance strengthens the credit of firms adopting it. And the increased confidence it establishes, recognized in the mercantile community, is reflected in the agency's reports. The general manager of another widely known agency recently said:

> A concern whose officers are not of value to it ought to go out of business or get new officers; but if the officers' lives are valuable, the corporation should not carry the entire risk of their loss.

Good-will, as was pointed out by a former attorney general of the United States, is property capable of being appraised, bought, and sold. In many cases it is the main ingredient of value, representing all the struggle, industry, tact, and judgment that have gone to make success. Business insurance puts a tangible substance back of that part of good-will which is represented by human personality, and in so doing it becomes a shock-absorber of tremendous importance to the organization concerned, and to the related individuals whose comfort and happiness depend upon an unbroken continuity of business success.

An insurance company which does a large business in firm and corporation policies makes these claims for business insurance: It protects creditors and meets their demands; increases a firm's borrowing privileges; affords an available emergency reserve; keeps the pay-roll going during emergency or transition periods; provides funds, when death splits a concern, to pay off retiring members; indemnifies for loss of the most valuable commodity in the world—brains. The same company further asserts that this form of insurance often determines the solvency of a concern; it indicates progressive financial policies and consideration for the safety of all interests concerned; and it is essential because the mercantile agencies now give business insurance coverage in their reports of a concern's rating or of a firm partner's death.

Bankers are also urging the importance of business insurance, following the lead of the late A. Barton Hepburn, who said:

> Business life insurance not only means a certain amount of cash when most needed, the value of policies, dividends, etc., that may be available in the event of loss, but it is also an evidence of financial morality, of willingness and desire on the part of a business man to adopt every instrument which will protect his business and his creditors.

Such insurance stabilizes the credit of a firm, prepares the way for a ready acceptance of its paper, prevents the calling of loans in time of panic or industrial depression, and, as has already been suggested, gives good-will an absolute financial value.

Finally, and by no means the least important consideration, premiums paid on firm or corporation insurance are not wholly lost so long as the policy remains in force. They constitute an asset to be carried as such on the books, in an amount equal to the annually increasing cash surrender value stated in the policy.

To the Directors of the Sesqui-Centennial

THE announced plans for the exhibition to be held in Philadelphia in 1926, to celebrate the 150th anniversary of the signing of the Declaration of Independence, provide for forecast of the "social and material progress during the next 50 years by reviewing that of the past half century." Among the ideas to be developed are: Artisanry and economics; economic teachings; good conditions in the workplace; sound relationships; conservation of resources. These elements assure the industrial character of the exposition, but reviewed by themselves will not appraise the possibilities of progress from 1926 to 1976.

There are plenty of signs which point to the great advance which the American people are about to make —*the control of the conditions of human living.* To satisfy adequately the great announced purpose, this open-letter suggestion is respectfully made to the directors of the Sesqui-Centennial.

Dedicate the most important building in the industrial group to control. Set apart a room or space for each major branch of American industry. In each room show the best, the most advanced, systems and methods for valuing and controlling the operation of the assigned branch of industry. Such systems would include: designing and standardizing product; purchasing materials; rough and finished stores keeping; production control, as planning, routing, dispatching and inspection; control of quality; cost accounting and cost control; co-ordinating sales and production; budgeting money, sales, and product; spreading risks and hazards; employee and industrial relations; physical and mental hygiene. The listing is suggestive rather than complete.

Such systems are American in spirit They have been born of the determination to shape and direct our great physical and human resources for the benefit of our people. Their application is bringing true industrial control.

A vast building set apart for their exhibition would be visited by every industrial executive who could possibly reach Philadelphia. Every visitor would carry away a purpose to improve the quality of the control of his own plant. Thus would come the directing impulse which would carry America forward for another half century of progress.

The slogan of the Sesqui-Centennial is—"Ring it again!" Let us add—"Ring in the new era of industrial enterprise!"

The Anthracite Report

ANOTHER chapter has been written in the great human document of control of industry. In no other way can the report of the United States Coal Commission on the anthracite industry be viewed. Its effects should be to stabilize the industry, to inform Congress and to help build a national policy toward industry and labor.

The anthracite industry, so the Commission holds, "is quite as much a public necessity as gas, street railway service, or any other service or commodity that has been brought under regulation" because it is "a necessity for millions of our people." Therefore the "relatively small number of individuals, estates, and companies" interested in production and transportation should not be allowed absolute control of its operation.

With this view a large proportion of the American people will agree, and will concur in the recommendation that the same regulation should be exercised as governs the operation of national banks, water, telephone and railroad companies. "The guiding principle in such enterprise is no longer maximum profit to owners but maximum service to the public," and "the time has come to establish the same controlling idea in the anthracite-coal industry."

This conclusion reaffirms the twofold profit and service motive. Then follows this recommendation:

> The President of the United States should be authorized by act of Congress to declare that a national emergency exists whenever, through the failure of operators and miners in the anthracite industry to agree upon terms of employment, or for any other reason, there is a suspension of mining operations seriously interrupting the normal supply of anthracite fuel in interstate commerce, and to take over the operation of the mines and the transportation, distribution and marketing of the product.

Profiteering and wage advances are the alleged reasons for the increase in anthracite prices during the past 10 years. Insufficient facts are available to support either accusation. It is pointed out that the cost per ton produced by 9 mine-owning railroad companies advanced from \$2.23 in 1913 to \$5.75 in 1923. Corresponding figures for 3 independent companies are \$2.50 and \$6.32. And further:

> . . . The increase in mine costs for these 12 companies was moderate until 1918, when for 3 successive years there was an annual jump of approximately a dollar.

These facts are a major reason for recommending publicity for costs, prices, and profits, for such disclosures would tend to put the temptation to increase prices under restraint. Another reason is:

> The opportunity for inflating figures of costs are so numerous and the questions as to how investment shall be reckoned are so unsettled that without such continuous publicity the Commission fears that the concentrated control of the anthracite industry may take indefensible profits.

Concerning rail transportation as a part of cost, "the item of freight alone takes from 16 to 30 cents of the consumer's dollar," and, "A re-examination of the reasonableness of anthracite freight rates" is advised.

Equally positive and constructive are the recommendations concerning management and practice.

In line with the national movement toward simplification it is urged that the present 7 standard sizes be reduced to 4. This forward step can best be taken by a joint conference of "producers, railroads, retailers, and chairmen of state and municipal fuel committees, and the Bureau of Mines. . . ."

Complaints in regard to poor quality have led to this suggestion, that the anthracite producers "join in an intercompany inspection service which shall be empowered to prescribe standards, inspect and sample shipments, reject inferior coal, and certify if not guarantee—the quality of coal passed." If this proposal is not accepted or should not work out in practice the Commission recommends further "that a federal law should be enacted for permissive grading and inspection."

Of economic significance is the possibility of substituting other fuels for anthracite, for "building up the demand for substitute fuels is one form of insurance against combinations of labor or of capital and the consequent rising prices."

As elements in an enlightened labor policy it is recommended that excessive hours of labor be eliminated, wages and conditions of employment of miner's helpers be readjusted, personnel managers be employed to handle labor matters, aliens be assimilated and Americanized, a joint committee be set up to prepare a code for the industry, and that a joint committee secure scientific analysis of the jobs in the industry.

The report as a whole is direct, impartial, and constructive. It points the way to steady production, fair prices, better relations between operators and miners and between the industry and the public.

THE READERS' PAGE

Order Control

Editors of MANAGEMENT AND ADMINISTRATION:

In going over Mr. J. P. Jordan's article in the March issue of *Management Engineering* on "Managerial Control Through Costs," I find that he mentions "order control" as one of the necessary primary controls. I do not exactly understand what Mr. Jordan intends to cover under "order control."

Orders to the plant to manufacture, machine, or ship are presumably covered, but when Mr. Jordan refers to "proper expense orders" I don't get what he has in mind at all. Just what does "order" mean?

Furthermore, I cannot see why the handling of orders to manufacture, etc. (which in the case of our company is taken care of by the planning or schedule department), comes under costs, except perhaps as the forecast of goods to be made influences the budget or the fixing of normals.

Mr. Jordan's article is extremely interesting and instructive. With the exceptions noted, it can be perfectly understood by the ordinary mortal, something that cannot be said of a great many articles on this and similar subjects. I will greatly appreciate having you refer this to Mr. Jordan for reply.

Acheson Graphite Company. A. M. WILLIAMSON.

Editors of MANAGEMENT AND ADMINISTRATION:

In reply to the letter of Mr. A. M. Williamson, I wish to say first that the control formulated by proper orders seems to the writer to be a basic secret of the success or non-success of proper records of cost and production. If every dollar paid out in labor and materials fails to find a resting place in the records in accordance with a predetermined plan, the resulting costs, either direct cost of product or the indirect costs, will prove of little value.

If an assembled product is being manufactured, it is rarely the case that a single order can be issued to cover the manufacture of one item of the product. This is so on account of the fact that many of the individual parts are manufactured far in excess of the immediate requirement of this one assembled unit. For instance, we desire 25 assembled units which may consist of 100 individual parts. Many of these parts are common to other assembled units, and in addition must be manufactured in a manner to provide additional stock to be sent out as repair parts.

Therefore, the production orders should be first of all issued for individual parts, which parts will go into stock in manufactured form. Many of these parts will be made in multiples of one or two or possibly five hundred pieces. The next step would be orders for the assembly of minor units of the final assembly, which in turn would go into stock. Lastly, the order for the 25 assembled units desired would be issued. Any other way of issuing the orders would absolutely preclude proper handling of production in the shop and would most effectually block the figuring of costs.

Intelligent control of expense departments such as electric power, steam, trucking, restaurant, general superintendent's department and the like, together with the burden cost of the operating departments, requires a predetermined analysis of what items of expense must be known month by month. Fig. 8 in the April, 1923 issue of *Management Engineering* and Fig. 9 in the May, 1923 issue of *Management Engineering* illustrate the analysis afforded by properly planned expense orders. It is not enough to know a lump sum amount which purports to cover the cost of either an expense department such as the electric power, or the burden of a machine shop or any other shop. If the management wishes to enlist the greatest interest of the foremen it is necessary to find out what items of expense in each department are most important from the standpoint of monthly control as well as from the standpoint of peculiar expenses such as No. 1004 in Fig. 9, which will give data to support the consideration of labor-saving devices for handling material.

These expense orders are set up for each department and numbered in logical sequence, and the original time and material records will charge all expenditures in accordance with these orders.

At the close of the month, the charges to all these expense orders will be added up and the total for each department should agree with the charges to the standing orders, and when set up in comparative form, as in Figs. 8 and 9, the management and the foremen have a very tangible method of controlling the cost.

It is really an absolute impossibility to control costs for managerial use unless expense orders for monthly closing are set up in accordance with the information which it is necessary for the foremen and the management to have to execute and carry on cost cutting campaigns.

J. P. JORDAN.

Employer-Employee Relationships

Editors of MANAGEMENT AND ADMINISTRATION:

The employer-employee relationship at the Riverside and Dan River Cotton Mills has been solved to the employees' satisfaction to such a degree that the workers have initiated a campaign to tell other industries about it.

Industrial democracy prevails at these Virginia cotton mills. The industrial government is patterned after the federal government. There is a House of Representatives, a Senate and a Cabinet. The Cabinet is composed of the president of the corporation and half a dozen superintendents and higher executives. The Senate is made up of mill foremen. The representatives are elected by the workers, each department having representation in this body. Under the constitution an assistant foreman is eligible to election as representative, but few of them are so elected. The worker voters in most instances have the feeling that one of the rank and file, and not an assistant foreman, would be more likely to reflect rank and file sentiments in House balloting.

The House of Representatives can vote—and has voted—a wage increase to the rank and file workers who elect the members of the House. The House of Representatives can vote—and has voted—to decrease the wages of these people.

The Cabinet has the power to veto a bill passed by the House and approved by the Senate. But out of over 400 bills thus far passed by this "Congress" not one has been killed by the Cabinet.

On two different occasions since the armistice, a wage cut has been voted. On one occasion when a wage change was seen to be inevitable, fifty different bills were introduced in the House. Finally committees from the House, Senate, and Cabinet got together and threshed the matter out. They worked nights for weeks. The records of these hearings made a bound volume six inches thick.

The employer, as represented by the Cabinet, laid all cards on the table. The rank and file employees, through the reports of their "congressmen" made either formally at a meeting or between bites at noon time, comprehended pretty well in the end just about what the cotton mills could and could not do in the way of wages.

The wage cut bill was not passed by the House unanimously by any means; but, however, by a large majority. There were some rank and file workers who wanted to keep their high wages whether or no. And some "congressmen," in order to hold their jobs, voted as their constituents directed regardless of the facts established by the committee hearings, proving that "congressmen" are alike whether they sit in Washington or in Schoolfield, Va.

The result of this system of industrial democracy was that in the end the great majority of workers were convinced and satisfied that a wage cut had to be. And while wage cuts were answered by strikes in other textile mills, the Riverside and Dan River Cotton Mills continued full speed ahead.

With the rise of industrial democracy in these mills interest in trade unionism waned. Unionism made its "last stand" in the machine shop. But gradually workers in this department became "citizens" of the democracy. Public sentiment among other workers had something to do with the machinists' "taking out naturalization papers." These others took the position that since the machinists were participating in the benefits of industrial democracy they ought to climb on the band wagon and support the democracy by their membership.

The workers became so enthusiastic over their system of industrial government that they determined to tell others about it. A five-reel motion-picture, produced by the Rothacker Film Company [illegible] was one of the mediums selected to [illegible] formation. This picture may cause the American [illegible] to see the cotton industry in a new light. No child labor or unhealthful workrooms in the R[illegible] and Dan River plants! Enough of textile man[illegible] shown to give to the audience the effect of a personal trip through the mills, where are seen the principal processes raw cotton goes through to become a finished bolt of cloth. And everywhere are seen ideal shop conditions, and workers whose faces tell the movie camera that they are contented and in earnest about their jobs.

The screen audience attends meetings of the House, Senate, and lastly the Cabinet, which is presided over by H. R. Fitzgerald, president of the corporation. The audience attends athletic events and social affairs given by mill departments. There is a trip along some of the residential streets where the corporation will help a worker finance a home. Inside of one of the schools the audience observes that nothing in the way of educational advantage is too good for the children of these workers.

Every so often a professional trouble-maker will hire a hall and try to stir up discontent on the ground of paternalism. But he does not get to first base. So far as the workers can see, there is no paternalism—the corporation meets them "fifty-fifty" on a number of matters, but gives them nothing outright. The schools are an example. The workers as taxpayers of the county would ordinarily provide their children with indifferent school buildings and poorly paid teachers for six months in the year. But when the corporation matches the taxpayers' school moneys dollar for dollar, the finest school buildings, university graduates for teachers, and a nine-month term become possible.

A. L. PARKER

New Ideas in Office Building Management

Editors of MANAGEMENT AND ADMINISTRATION:

As executives are manifesting unusual interest just now in the way office buildings are run, I venture to tell your readers something about what we have done in Seattle, where we have the largest office building group (under one management) in the world. Many building experts have told us that in addition to being the largest, it is also the finest in beauty, territorial extent, floor acreage, and unique methods of operation.

First of all, I may be permitted a personal word. Sixteen years ago the writer came to Seattle, a young lawyer, from North Dakota. Seeing an untouched ten acres of land, overlooking Seattle's great deep-sea harbor, I visioned it as the future business center of the city. Hunting up the lease-holder, I studied the lease, got a Seattle man to put up part of the money, traveled East and got the rest, and took over the lease. Today our company can point to our four city blocks, containing twenty of the finest office and store buildings to be found anywhere.

We are proud of our buildings, but more so of our own ideas and our ideals. We have been able to do much toward putting building and rentals on a sound basis in this part of the country. We are working out ideas which we are confident will be helpful to those who are to follow the profession (for we call it that) of building management. And we even hope to see the time when chairs of building management will be established in the leading colleges and universities of the United States.

The new type of manager that is coming into the business of building management is prepared to make a scientific study of the building business and to apply the best management methods. Most of the managers, who have not had the same preparation as some of the new men in the business, have been quick to see that only by a thorough study of the business could they make the most of their opportunity. Some of these men have pushed themselves into the first grade of building management. In other words, there are in the business a large number of men thoroughly prepared and who are the real hope for leading the business into better ways. The old hit and miss methods have been abandoned and we are gradually approaching the point of scientific operation and management.

In nearly every section of the country, space in the earlier office buildings rented without service of any kind. Gradually the owner began to furnish heat, janitor service, elevator service, care of corridors, public toilets, and other public spaces. Repair and maintenance service and various other types of service now are well established in all office buildings.

There has been some diversity in the development of some of the services commonly rendered by building owners. In about three-fourths of the cities of the country, the owner does not furnish light globes or electric light. This service is paid for by the tenant. In most cities in the country no towel service is furnished in lavatories. In a few cities towel service is furnished. In a great many cities heat is not furnished to the ground floor tenants. While a uniform program has grown up with reference to furnishing many kinds of service, other services are not yet uniform. The evolution in the office building business has brought us to the point where the owner now furnishes practically every service in connection with the use of the building. Most of these kinds of service are included in the rental, but few types of service are charged to and borne by the tenant.

Where rentals are based on cost, it is necessary first to determine what items should be included in the cost. There are certain features in rental costs about which there is very little difference of opinion. Every building manager figures that janitor service, elevator service, heat and other similar items are part of the operating cost. There are many managers, however, who are very hazy on some of the items that go to make up the cost of a building business.

Frequently the item set up for depreciation and obsolescence is not large enough. And more frequently there is no item figured in accounts for contingencies. I think the safe way to figure a building proposition is to figure at least 3 per cent on the original cost of the structure for depreciation and obsolescence. This item is so well understood that there is only a matter of about 1 per cent, on the cost of the structure, difference in the standards of the managers who take account of it.

A contingency item should be set up to take care of the unusual things that cannot be figured. The San Francisco fire, for instance, was a contingency item. If one building had been burned, it could have been rebuilt quickly, but where the whole business district was destroyed, it took a long time to get the city straightened out so that rebuilding could go ahead. I believe that at least 2 per cent of the gross rental of a building should be set aside to take care of contingencies.

There should be included in the cost, interest at the current rate on the reproduction cost of the building. A manager who is only earning current interest in operating a property is not making a success of a building business any more than a merchant would who borrowed money from a bank at 6 per cent to operate and actually earned 6 per cent. The only profit there is in the building business is the amount of net earnings above current interest on the value of the property. No business tenant will dispute the fact that we are entitled to some return for the operation and management of the business.

Assuming, therefore, that we have arrived at the proper costs of operating an office building, the question is what relation has this cost to the amount of rental to be charged. Until some better suggestion can be made, I suggest that the building owner charge an amount approximating 7 per cent of the operating cost for profit and for management service. Assuming that a space costs $2 per square foot, on this basis the owner would charge $2.14 per square foot. This charge of 7 per cent of the gross rental generally averages about 2 per cent on the cost of the building and its site.

I feel that this figure is a very inadequate one for the service the building owner renders and that this figure should be much higher, but until both the owner and tenants of business properties are educated to some more favorable standard, I suggest some such rule be adopted. As far as the office rentals themselves are concerned, there should be a fixed relation between costs and rentals just as the merchant has a fixed rule for adding a margin to his merchandise cost. I believe when the tenant comes to understand that there is a good fair rule for fixing rentals and understands that rentals are not fixed by the hit and miss method, there will be very little complaint about rental schedules.

If there is any material drop in operating costs so that the owner gets more than a fair return for management and operation, the rents must be lower. If, on the other hand, the cost sheets show that the owner is getting too small an amount for management and operation, then the rents must be increased.

Secretary and General Manager, J. F. DOUGLAS
Metropolitan Building Company

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

PREPARED BY LEWIS H. HANEY[1]

Director, New York University Bureau of Business Research

The Barometer of Industry and Trade

Conditions Likely to Improve in the Fall

The fact that there is so much uncertainty concerning the future of business and that forecasts differ so radically seems to indicate the probability that we are nearing a turning point in the outlook for the business future. As the trend has been distinctly downward since last November, it follows that if there is a turn it must be for the better. A careful analysis of conditions leads to the conclusion that a change is imminent and will relieve the strain under which industry now labors.

While some further recession of business seems almost certain, it looks now as though the rate of decline would soon begin to diminish and the bottom be reached before fall. The barometer, Fig. 1, has been indicating the turn for six months. In June, finally, the main forecasting line ceases to decline, the failure bars show an upward trend, and the interest-rate curve moves down to a point nearer the center of the normal area.

The course of the $\frac{P}{V}$ line during recent months has been very similar to that of 1920 (see Fig. 1), but there are several important differences in the situation. The line itself when it attained the peak last November hardly advanced above the normal area, and for the last month it showed a fractional rise rather than the decline which occurred in June 1920. More than this, the interest-rate curve is now but little above the center of the normal area, while in 1920 it was high up in the area of boom and crisis. To these facts we may add that the reserve ratio is now above normal, and that failures have never become abnormally few but are still gradually declining in number. Consequently a relatively mild depression is the forecast.

The $\frac{P}{V}$ line began to decline in December and has continued downward since that time. As usual, the stock market followed the course of the $\frac{P}{V}$ line in about three months, turning downward in March. The general level of commodity prices followed suit a month later, Bradstreet's index showing a decline in April. The next step in the turn occurred in the indexes of business activity and production, which occurred in April and May. Building activity, bank debits, iron production,

[1] Valuable assistance was given in the compilation of data by Karl W. Johnson and Horace J. Barney of the Bureau Staff.

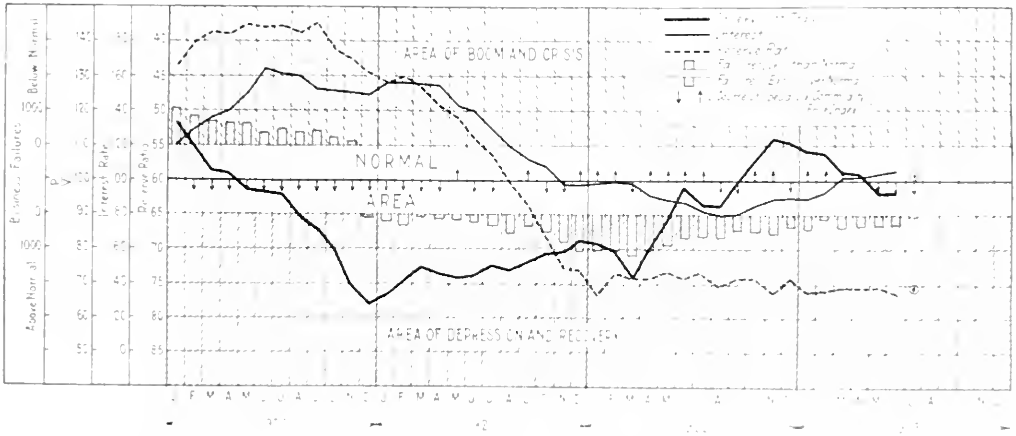


Fig. 1 THE BAROMETER OF INDUSTRY AND TRADE. INDICATIONS POINT TO A PERIOD OF RECOVERY

Areas in which curves lie indicate that business is good, normal or poor, respectively. Curve P/V shows the trend of demand, and is the ratio between Bradstreet's index of wholesale prices and physical volume of trade (carloadings times tons per car), based on 1912 as the normal year. A rise in the curve indicates increasing demand, and vice versa. The P/V curve has been corrected for seasonal variation from January 1923 on. Interest rate curve has been corrected for seasonal variation, and index number 100 equals 5 per cent. Federal reserve ratio of cash reserves to note and deposit liabilities is inverted to harmonize its indications with the rest of the curves. Business failure bars are based on Dun's reports, and "normal" equals the trend for 40 years. Six-Commodity price index based on N. Y. U. Bureau special investigation. July 1923 data shown is probable trend.

steel orders, employment, imports, and mail order sales, all show that the peak has recently been passed.

It is thus apparent that there has been a fundamental cnange in conditions which has cyclical significance. As already stated, however, the recent peak of business was not marked by any excess boom conditions and consequently we may reasonably expect a smaller reaction. The extent to which adequate warning and prevalence of more scientific study of business conditions are responsible for this condition is an interesting subject for conjecture.

As to the future, the chief problems concern prices, wages, agricultural depression, exports, and legislative restriction of business.

Prices. Prices are clearly on the decline at present, but it does not seem that the decline will go a great deal further, nor last so long as it did in 1920-1921. There was little or no inflation in the 1922-1923 advance in prices. Above all, signs are not lacking that the overproduction which has been the chief factor in recent adverse conditions is being relieved. The production of iron and steel, and cotton textiles, for example, has been checked, and the latest news is that the production of crude oil may soon be brought within limits. This situation finds expression in the course of the $\frac{P}{V}$ line, the decline of which ceased in June; in fact, the index number showed a small advance of one-tenth of one per cent. (This is too small a change, however, to have any positive significance.) It seems most probable, therefore, that the general decline in prices will come to an end within some such period as three months, and that it will be less rapid from now on.

Wages. Wages are still badly out of line with prices, and this is one of the most serious difficulties; but even here there is some light: (1) there is less labor shortage, and employment actually declined in the industries reported by the U. S. Bureau of Labor and in New York state during June; (2) the cost of living is relatively low compared with wages. It follows that the advance in wages is not likely to continue much longer, and that checking the advance or making necessary downward adjustments will not be as difficult as it often is. Some labor difficulties, however, are probable.

Agriculture. Farm demand will not be a factor in lending much support to industrial expansion. Rather, it will tend toward maintaining a semi-depressed condition on account of the bad wheat situation. Incidentally it will generate uncertainty by raising a crop of unsound legislative proposals.

Exports. The outlook for exports is bad, and while a settlement of the Ruhr situation would probably give some temporary relief, in the long run the United States must be prepared for difficulties in securing any large volume of exports for some years.

Legislation. As to the legislative situation, it undoubtedly constitutes a real menace and is responsible for no small part of existing uncertainty. No one can forecast it.

Conclusions. We conclude that the chief factors thus outlined are such as to prevent or check any very sharp increase in business during the rest of the year, but that things do not seem likely to get much worse than they now are.

An examination of the details of the barometer gives the following results:

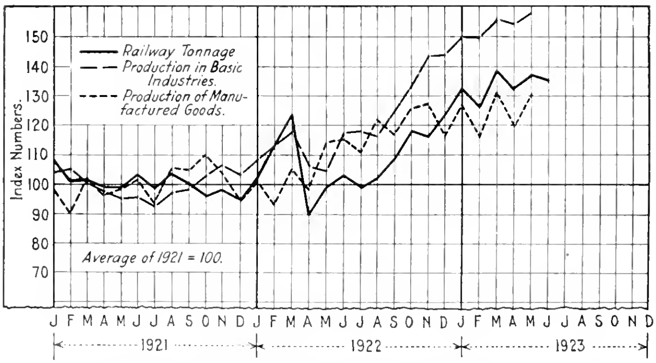
1. The six-commodity price index declined during June from 130.1 to 125, and is now about where it was in January. It will show further decline in July, which will probably bring it near to the December level, at which point resistance is likely to be met.
2. The interest rate on commercial paper remained unchanged during June and the early part of July, but allowance for seasonal variation makes the barometer curve show a rise in June, followed by a small decline in July. The fact that the curve is so nearly normal is a hopeful sign. It is possible for depression to come without a preceding period of high money rates, but it is extremely unlikely for a severe or prolonged depression to come while money is "easy."
3. The barometer bars which indicate the excess of business failures over normal still fall in the "area of depression and recovery," but are shorter in June and July, indicating a steady decline of late in excess failures. Since both seasonal variation and normal growth have been eliminated, this trend is very significant of a more favorable outlook.
4. The $\frac{P}{V}$ line remained practically stationary during June, and forecasts diminution in the rate of decline in prices and business activity. It is worth noting that physical volume decreased in June to such an extent that had prices not fallen or had they fallen a little less, the ratio of physical volume to price would have shown a considerable increase. In other words, the situation has changed, for down to June physical volume has been increasing at the same time that prices were decreasing. The outlook, therefore, is for some improvement in the intensity of demand and for a less rapid fall in prices. (It has become unlikely that the stock market will show much, if any, further decline.)
5. The federal reserve ratio, after adjustment for seasonal variation, increased during June, which checked the slight but steady decrease which had been going on since January. The outlook now, however, is for resumption of the decrease in July. These minor changes have little significance. Reserve credit has hardly been tapped.

Production and Movement of Stocks

Decrease in Production Follows an Accumulation of Goods

The figures shown in Table 1 lead to the following conclusions:

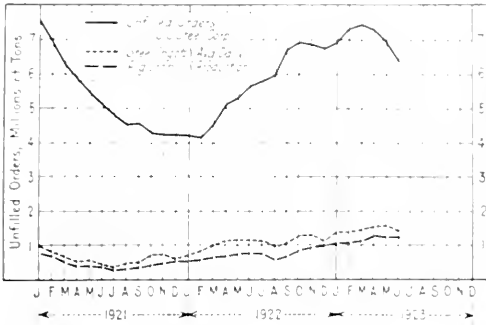
Stocks of gasoline and tires have increased steadily, and indicate a bad situation. After allowing for seasonal variation, gasoline stocks are the largest



Sources, Federal Reserve Board, N. Y. U. Bureau of Business Research

Fig. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

Railway tonnage and basic industries production corrected for seasonal variation, and the latter also for normal growth.



Source: Iron Age, American Iron and Steel Institute

Fig. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS

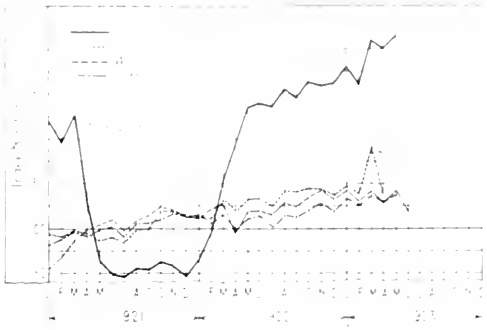


Fig. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES

for any month ever recorded. Apparently zinc stocks are beginning to accumulate, though they are still small in comparison with the average for 1921. A small increase occurred during June in stocks of leather. On the other hand, a decrease in stocks of refined cottonseed oil and raw sugar seems to indicate a somewhat stronger position in those industries.

Copper. Trade reports have it that the stock of copper decreased considerably during June and fell below the two million pounds mark on the first of July. This movement follows a period of high production in the copper industry and shows a healthy condition still existing in that field, at least.

Newsprint Paper. Stocks of newsprint paper are again falling and have almost reached the minimum point of last October. Like leather and zinc they remain consistently at a low level.

On the whole, it seems that stocks are accumulating as demand falls off and before production has yet had time to slow down to a pace in keeping with demand. Taken in connection with other factors, such as a lessening of labor demand, this condition strengthens the indication of approaching stabilization and improvement.

Industrial Output and Railway Tonnage

As shown in Fig. 2, production in basic industries resumed its upward climb in May. The index number for that month showed an extraordinary gain over May 1922, amounting to about 38 per cent. Railway tonnage also showed a gain in May, and held practically level during June. After eliminating seasonal variation, the figure is approximately 33 per cent over a year ago. The failure of June tonnage to increase materially, after allowance is made for seasonal variation, indicates the recent slackening in trade.

Conclusions. The net conclusion from these figures is that manufacturing and mining activity has been at a very high level, and that there is danger of overproduction in some lines. The general price level is not apt to rise as long as the production curve continues upward so sharply. Another point of interest is that the curve of production in basic industries has climbed so much higher than the curve of railway tonnage. The conclusion would seem to follow that stocks of basic products in some industries must be accumulating.

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
(Index Numbers. Average for 1921 = 100)

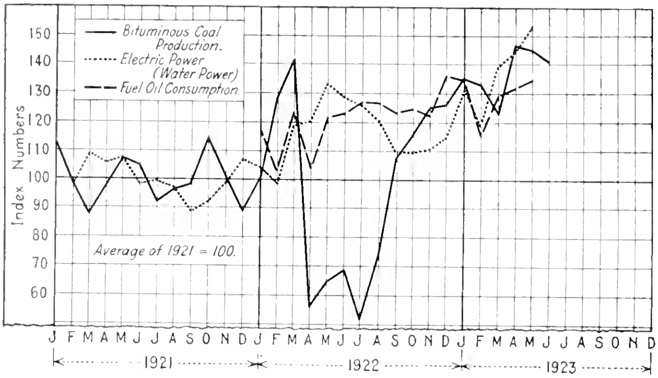
Month and Year	Gasoline*	Leather (Cattle)	Zinc	Newsprint Paper	Automobile Tires	Raw Sugar	Cotton-Seed Oil
	100 = 630,757,000 gals.	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,000 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.
Jan. 1921	89	100.7	52.2	82.5	126.2	55.9	107.4
Feb.	93	102.5	98.4	108.0	121.9	54.5	114.1
Mar.	92	102.1	101.1	130.5	119.0	86.1	140.9
Apr.	92	102.5	104.9	139.3	105.3	76.8	144.2
May	104	100.8	103.1	117.0	103.7	164.7	146.0
June	103	104.4	108.4	104.0	102.0	196.5	130.8
July	109	100.5	116.4	88.7	95.2	170.0	117.3
Aug.	108	99.5	119.7	85.0	89.2	106.1	89.4
Sept.	109	99.5	112.1	90.4	90.2	97.4	61.0
Oct.	102	96.4	105.1	100.8	76.6	93.8	34.2
Nov.	102	95.9	91.7	76.7	81.2	48.9	46.0
Dec.	103	95.2	86.8	77.1	89.6	48.9	74.2
Jan. 1922	110	98.5	78.5	79.8	84.7	27.5	101.2
Feb.	110	99.0	85.1	88.5	95.6	46.7	107.7
Mar.	110	100.7	83.1	92.7	107.5	116.1	113.3
Apr.	110	95.4	78.1	93.9	118.8	202.2	117.3
May	111	101.5	67.0	82.9	125.2	197.8	118.7
June	114	101.6	52.3	82.6	126.6	179.5	99.8
July	123	98.3	38.3	77.9	115.5	166.8	82.7
Aug.	133	97.4	37.1	70.5	110.8	208.5	64.4
Sept.	146	91.5	28.0	66.3	106.1	148.0	41.7
Oct.	161	90.2	24.4	62.7	105.7	90.0	21.8
Nov.	160	87.7	23.4	65.8	107.3	49.6	22.6
Dec.	156	85.9	25.3	65.4	113.8	28.2	36.8
Jan. 1923	156	85.3	23.6	64.0	105.4	15.8	57.0
Feb.	154	84.0	21.5	76.7	107.6	40.2	77.1
Mar.	162	82.6	14.1	77.3	119.7	73.4	88.6
Apr.	164	81.6	13.0	67.2	129.9	184.3	93.9
May	173	81.4	11.6	62.9	139.3	211.1	92.3
June	...	82.2	16.9			166.6	
July			22.2				

*Last of month.

Iron and Steel Production

The facts charted in Fig. 3 show a considerable recession in the iron and steel industries. This is partly seasonal, but in part it represents a decline in business. The proof of the latter statement is found in the price situation. Pig iron has declined rather steadily in price during the month, and the composite price indexes of iron and steel products show recessions, though steel has held up better than iron.

Unfilled Orders. The unfilled orders of the United States Steel Corporation have now declined for three months in succession, and during May and June the declines were considerably greater than anticipated. The June unfilled orders were 595,000 tons lower than those of May. The volume of business is still good, and mills are operating at about 90 per cent of capacity, but the



Sources, Department of Interior; Bureau of Mines; United States Geological Survey

FIG. 5 FUEL AND POWER PRODUCTION

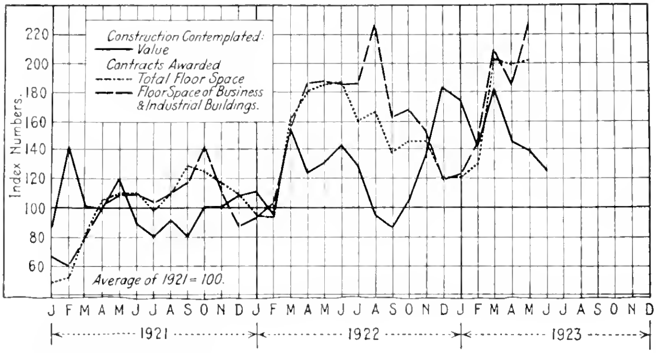
outlook for the rest of the year is uncertain.

Pig Iron and Steel Ingots. The daily production of pig iron declined for the first time in a year. The average daily output in May was 124,800 tons, while in June it dropped to 122,300 tons. The average daily production of steel ingots has now decreased for two months. The June figure was 144,200 tons against 155,400 tons in May.

Production in Important Industries

Copper, Cotton, and Wool. Fig. 4 tells no complete story, but contains important information about certain industries. Copper mine production increased in May, which is the latest month for which figures are available, to 124,785 pounds against 118,423 pounds in April. This brings the curve to the highest point in the period covered. Trade reports show that the refinery production of copper was down in June to 178,000 pounds against 185,000 pounds in May, and the June mine production will probably show a drop. Cotton textile production, as indicated by the quantity of cotton consumed, reflects the curtailment in that industry. There were 542,000 bales of cotton consumed in June against 621,000 bales in May. Active spindles totaled 34,843,000 against 35,390,000 in May. In June last year the number of active spindles was 31,877,000. The consumption of wool increased in May, but was smaller than the consumption in March. The paper statistics of the Federal Trade Commission have been discontinued, but will be carried on later by the American Paper and Pulp Association.

Conclusion. The indications are that the four industries will show a curtailment of output beginning with June.



Source, F. W. Dodge Company

Fig. 6 BUILDING CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

Fuel and Power Consumption

The general trend of the curves shown in Fig. 5 indicates a high level of productive activity during recent months. The apparent consumption of fuel oil and electric power has been considerably greater than a year ago at this time. The two outstanding facts are the notable increase in hydroelectric power output and the continued downward trend of bituminous coal production. The output of hydroelectric power of public utility power plants in May was the greatest ever recorded in this country. On the other hand, the June index of bituminous coal production shows a sharp decrease, the significance of which is the greater, since seasonal variation has been eliminated. The bituminous coal production is a fairly good barometer of industry, and while a two months' decline is not decisive, the trend of the curve next month will be awaited with interest, as a continuation of the decline through three months would be highly significant.

Fuel Oil. The consumption of fuel oil showed a considerable increase in May and was greatly above May of last year, but did not attain the point reached last December.

Conclusions. To sum up, the fuel oil and power chart shows a high industrial activity in April and May, but the downward trend of the bituminous coal curve indicates a turn in manufacturing conditions.

Building Activity in June

Contracts Awarded. The total value of all contracts awarded, as reported by the F. W. Dodge Company, declined 14 per cent in June. Probably the most notable fact shown by Fig. 6 is the sharp decline in the value of contemplated building projects, which decreased 11 per cent from May. This is the third successive monthly decrease. Moreover, it brings the contemplated projects below the figure for June 1922. This continued downward trend forecasts decreased construction.

Floor Space. The total floor space covered by contracts awarded in May held up well. The floor space covered by contracts for business and industrial buildings increased sharply in May, which probably reflects work planned during recent months when the business outlook was brighter. The total floor space of all contracts awarded exceeds that of last year by less than might have been expected.

Conclusions. During the last three months, therefore, the gain in building activities over last year has become less, and careful observers think it probable that the peak of 1923 construction was reached in May. There is still an unsatisfied demand for buildings, however, and activity should continue at a good rate throughout the remainder of the year.

Material and Labor Costs. Metals, lumber, and linseed oil are reported to be somewhat cheaper, but brick and cement have shown a firmer tendency in several markets. The increases in basic wage rates in New York of from $1 to $2 per day mean an increased burden of cost on New York building during the next six months, estimated to amount to over $18,000,000.

Trend of Trade and Finance

Business Activity Declines. Money Conditions Still Good

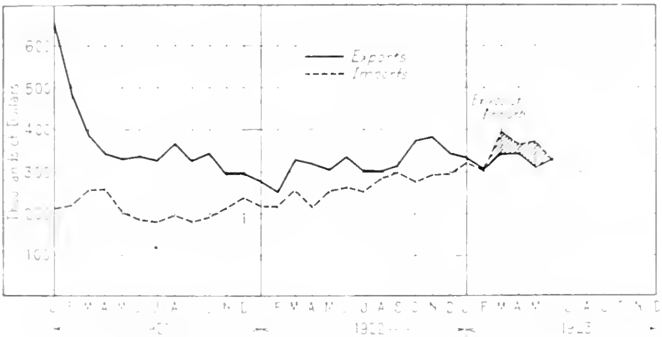
Exports and Imports

Imports. The most notable point in Fig. 7 is the sharp decrease in imports which occurred during June. Imports are a fairly good barometer of industrial conditions, and the June decline may be taken as a further indication of a recent set-back. Merchandise imports fell from $370,000,000 in May to $328,000,000 in June.

Exports. At the same time, exports increased by $10,000,000 and amounted to $329,000,000 in June. As a result, our balance of trade became favorable, though the excess of imports over exports only amounted to $1,000,000. For the fiscal year ending June 30, 1923, our total balance of merchandise exports over merchandise imports was only $177,000,000, which is nearly a billion dollars under the figure for 1922.

The export situation is not encouraging. The June figure was the smallest in a good many years, and it is significant that merchandise exports have declined steadily from $928,000,000 in June 1919 to $329,000,000 in June 1923.

Conclusions. The underlying cause of the foregoing situation is the relatively high level of prices in this country (when prices are put on a gold basis) and the low purchasing power of Europe. These things result in low foreign exchange rates, and, together with our high tariff, tend to check foreign buying in this country. We may expect a continuation of very small favorable balances or unfavorable balances until prices and exchange rates become readjusted.



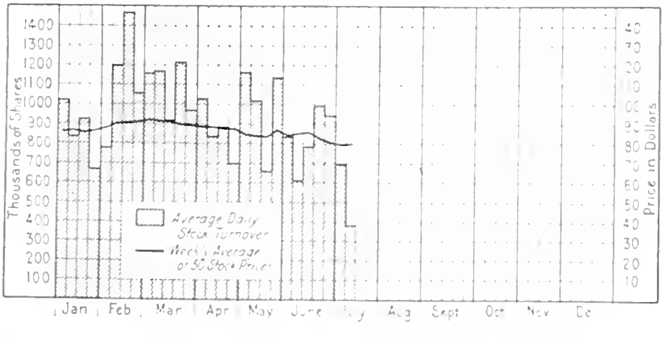
Source, U. S. Department of Commerce

Fig. 7 FOREIGN TRADE IN THE UNITED STATES

The Stock Market

Fig. 8 shows that since the middle of June there has been a decrease in the average price of [illegible] stocks [illegible] a decline of [illegible]. Between the middle of [illegible] it was evident that liquidation was proceeding apace. As the price of stocks declined, the volume of trading also fell off sharply, with the result that the bottom of the recent decline was reached during the week ended July 7.

Conclusions. The average price of 50 stocks rose slightly during the week of July 14, but at the same time the average daily number of shares traded fell to a very low level. This shows extreme dulness and lack of speculative interest. It indicates that at present there is nothing in sight to cause the stock market to advance. The price of stocks is a good barometer of industry. In its decline it has forecast the recession in business. It may be expected to indicate business recovery several months in advance when and if it begins to rise. The outlook at this writing is for a continued dulness in the stock market, with only minor changes for the next 30 days.



Source, New York Times

Fig. 8 STOCK TURNOVER AND PRICES ON NEW YORK STOCK EXCHANGE FOR 1923

Bank Debits and Postal Receipts

The most reliable indexes of general business activity (shown in Fig. 9) indicate a considerable decline in June. The factors upon which this statement is based are bank debits to individual accounts and post-office receipts. In both cases seasonal variation has been eliminated. The figures are shown in the following table:

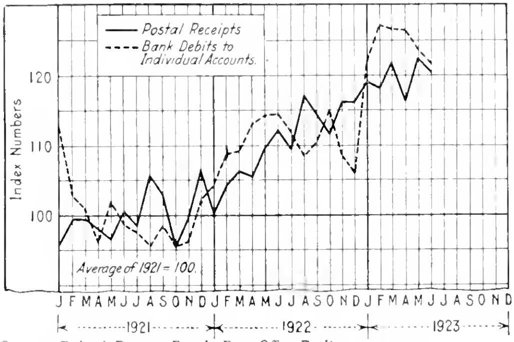
1921	BANK DEBITS	P. O. RECEIPTS
Monthly Avg.	100	100
June 1922	111.6	112.3
May 1923	123.5	122.4
June 1923	121.8	120.3

Conclusions. The peak of the bank debits curve came in February and of the postal receipts curve in May. The outstanding fact is the rather steady decline in bank debits during the last four months. This is clear proof that the activity of trade is on the decline.

Retail Trade

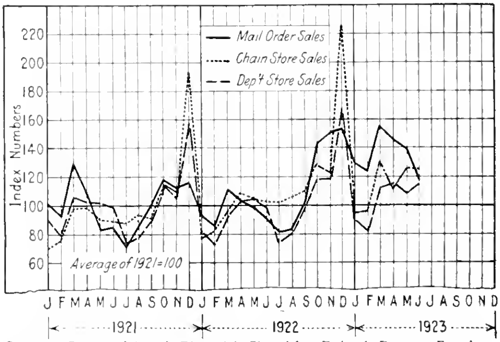
Mail Order, Chain, and Department Stores. The general level of retail trade, as indicated by the data covered in Fig. 10, has recently been in the neighborhood of 20 per cent over the same season last year. (This compares with a gain in general business activity of less than 10 per cent.) The June gain in chain store sales is noteworthy, for while it is small in absolute amount it has been usual for such sales to decline in June. There has been a three months' decline in mail-order sales. Department store sales show a relatively small gain in comparison with the last two years.

Conclusions. On the whole, the spring retail trade has been fairly satisfactory, but it has not kept pace with production in the basic industries, which has recently been about 35 per cent over the level of a year ago.



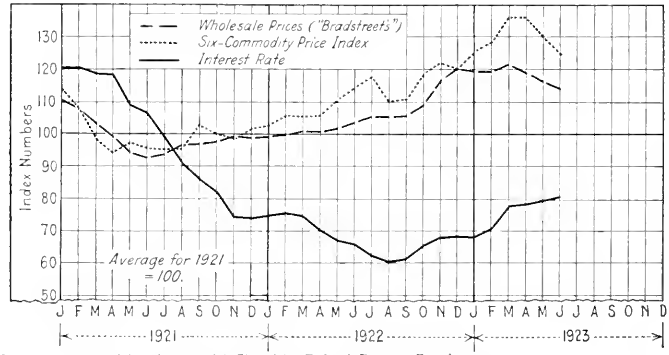
Sources, Federal Reserve Board; Post Office Dep't

Fig. 9 BANK DEBITS AND POSTAL RECEIPTS
Both curves corrected for seasonal variations



Sources, Commercial and Financial Chronicle; Federal Reserve Board

Fig. 10 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES
2 Mail order houses; 4 chain stores; 306 department stores



Sources, Commercial and Financial Chronicle, Federal Reserve Board

Fig. 11 WHOLESALE PRICES AND INTEREST RATE
Interest rate—monthly average, corrected for seasonal variation.

Prices and Money Rates

Wholesale Prices. Probably the most important factor affecting business during the past month has been the continued downward trend of wholesale prices. This trend was somewhat sharper in June than in May, and affected a wider range of commodities. The decrease, as shown in Fig. 11, was the greatest since May 1921. The largest declines occurred in foodstuff, metal, and oil groups. The coal and coke group was the only one which showed no decline.

Six-Commodity Price Index. The New York University Bureau's "Six-Commodity Index" showed a decrease which was even sharper than that of the Bradstreet index. Cottonseed oil was the only one of the six basic commodities which did not decline on the average during June.

As long as prices continue downward, we may expect continued hesitancy in buying and a less favorable outlook for profits. The end of the price decline is not yet in sight. If past experience may serve as a guide, prices will not rise until after the $\frac{P}{V}$ line of Fig. 1 begins to turn upward.

Interest Rate. The interest rate, as indicated on prime commercial paper, remained unchanged during June, holding at 5 per cent. Ordinarily, however, there is a small decline during that month and consequently the index number, which shows the trend with seasonal variation eliminated, rose slightly. It may be said that money rates were "firm" during June. The rate on commercial paper is generally slow to reflect changes in the general price level, but if prices continue their downward trend we may expect money rates to decline. It is not likely that interest rates will advance much further in the near future. Unless prices fall more than now seems likely, no considerable change in interest rates is in sight. Certainly there is no reason to anticipate a change in the discount rate of the federal reserve banks in the near future.

Conclusions. The net conclusion from Fig. 11 is that the outlook for business during the next three months is becoming less favorable, with commodity prices down and the price of money up. From the point of view of the business forecaster, however, the continued firmness of money at a level which is about normal indicates that business has not yet entered upon any serious slump. It would be rare for a major depression occasioned by falling prices, to come without the interest rate reaching a considerably higher level

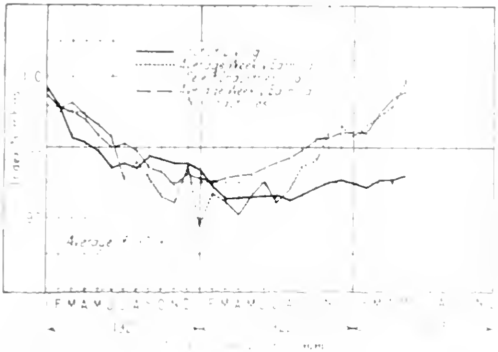


Fig. 12 Business Failures and New Enterprises

Adjusted for seasonal variation; 3 months moving average.

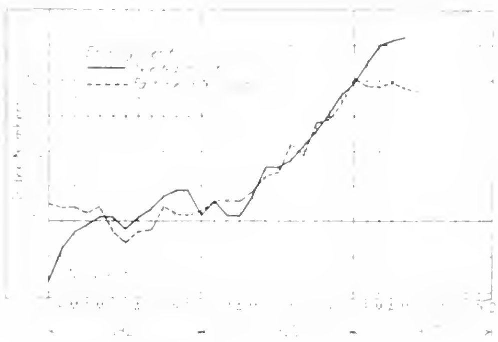


Fig. 13 Bank Credit and Federal Reserve Ratio

than any which now seems likely. Probably the rising trend of our index of money rates is due in part to the increased demand for funds by those who are meeting difficulty in disposing of goods or who require increased credit to carry stocks at declining values. On the other hand, it partly reflects the large volume of business which still exists and the increased mid-year requirements.

Business Failures and New Enterprises

As clearly appears in Fig. 12, the month of June marked a reversal in the trend of both business failures and new enterprises incorporated. The most striking fact is the sharp upward movement in new enterprises, which were more numerous in June than in any month since May 1920. On the other hand, the number of business failures as reported by Dun's declined slightly. The absolute number was much smaller than in May, but such a decrease is usual at this time, and when allowance is made for seasonal variation the decline is very small.

Conclusions. Both of the foregoing facts tend toward favorable conclusions as to the business future. The movement of new enterprises incorporated, however, is very erratic, and while it indicates greater hopefulness, it is difficult to base conclusions upon it. New oil and gas enterprises show a decline, while shipping and chemical enterprises increased. No small part of the increase was due to the incorporation of a number of mortgage and loan concerns in Delaware.

Bank Credit and Federal Reserve Ratio

The amount of loans and discounts made by 774 member banks increased slightly during June, and the federal reserve ratio also moved up. The reserve ratio is now nearly 28 per cent above its probable normal level, and continues to indicate the existence of a great store of credit, part of which is due to the fact that the United States holds something like three-fifths of the world's stock of gold. To the extent that this gold must ultimately be turned over to the other countries through loans and payment for excess imports of merchandise, it is really not part of this nation's reserve.

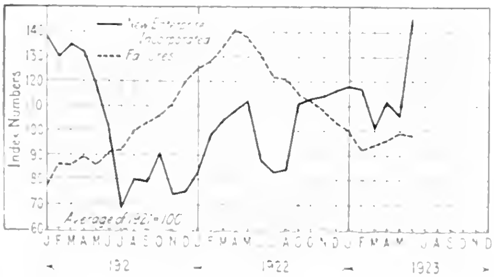
Conclusions. Fig. 13 shows that there has been an increased use of bank credit to finance the recent large volume of business, but that there is no undue expansion in the loans and discounts of member banks and that the federal reserve ratio is abnormally high. So far as these financial factors are concerned, there is nothing to prevent a continuation of profitable business or to check expansion.

The Wage and Employment Situation

Labor Supply Almost Balanced. Wages Reaching a Peak

The upward trend of wages continued during May as is indicated by Fig. 14. The cost of living index also rose slightly.

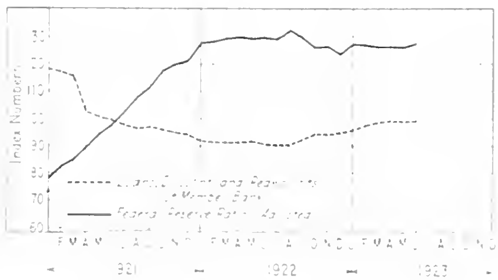
The rise in wages is not local, as indicated by the fact that the average weekly earnings both in selected industries throughout the United States and



Sources, U. S. Bureau of Labor Statistics, N. Y. State Dept. of Labor, National Industrial Conference Board

Fig. 14 Wages and Cost of Living

New York factories curve corrected for seasonal variations.



Sources, U. S. Bureau of Labor Statistics, N. Y. State Dept. of Labor

Fig. 15 The Trend of Employment

New York curve corrected for seasonal variations.

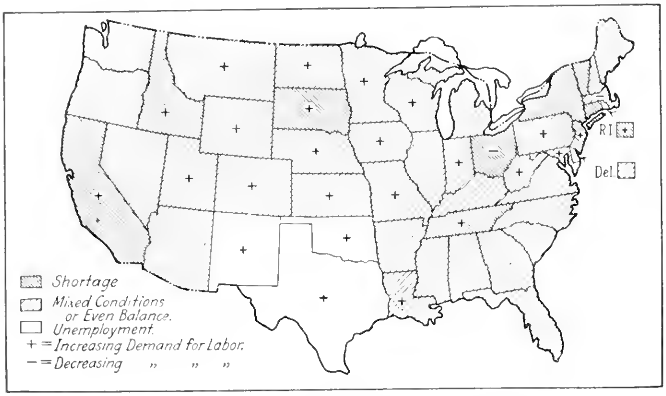


Fig. 16 CONDITION OF EMPLOYMENT BY STATES, MAY 1923

in New York state factories showed increases. Advances in wages are still taking place, although the major increases occurred in the spring and probably will not be duplicated.

As has been true for about 8 months, the advance in wages was greater than the change in cost of living would warrant. Roughly speaking, the average weekly earnings increased 3 per cent in May, while the cost of living increased only about 0.7 per cent. During the same time, wholesale prices declined about 2 per cent and retail food prices remained unchanged.

Conclusions. There is a slight indication of a check upon the up-swing in factory wages, as the New York state curve, after adjustment for seasonal variation, did not increase as rapidly in May as in the two preceding months. Since labor shortage appears to have passed the peak, this change may naturally be expected.

The Employment Trend

The latest data available, shown in Fig. 15, indicates that the peak of employment was reached in April and May. Employment in New York state factories decreased 1 per cent during June, which is the second successive monthly decrease. The June drop was partly seasonal, being affected by the usual slackening in the clothing trade, but the curve which is adjusted for seasonal variation shows that the decline has more significance than this. It indicates that the demand for manufactured products has been checked. The chief declines in employment in New York occurred in the following industries: Automotive, glass, rubber, cotton textiles, brass and copper, paints, vegetable oils, drugs and chemicals, enameled ware, agricultural implements, and typewriters. No unemployment is reported, except in clerical lines.

The latest figures available for the United States are those for May, but they indicate that the long upward trend of the employment curve has practically come to an end. In May, 27 out of 47 industries showed either stationary or decreased employment. Decreases are reported in boots and shoes, agricultural implements, sugar refining, stamping and enameling, book and job printing, flour and milling, and steel ship building.

Conclusions. The foregoing facts are strong indications of a general recession in business, and are of value as indicating the particular industries which are most affected.

Employment Conditions by States

In general, employment conditions in the various states, shown in Fig. 16, became somewhat more favorable during May. This improvement is evident by comparing the figure with that for the previous month, appearing in the July issue of MANAGEMENT AND ADMINISTRATION. There was less shortage reported in a number of states, while increased shortage appeared only in a few scattered states such as Tennessee, Rhode Island, and Idaho. A shortage of farm labor is, however, the rule.

Conclusions. It seems fair to say that employment conditions are pretty generally balanced in the majority of the states; that surpluses exist in the Southwest; and that shortage is rather general in parts of the Northeast and the far West. There is less tendency towards increased employment.

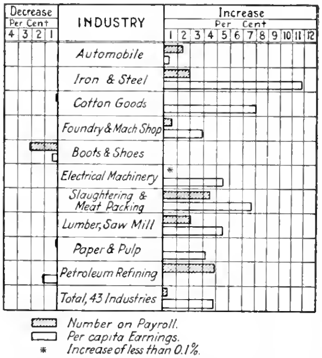
Trend in Selected Industries

In May, employment increased three-tenths of one per cent and per capita earnings 3.8 per cent. In the 10 industries covered in Fig. 17 the most notable points are that employment decreased in the paper and pulp industry and that large increases in per capita earnings were shown in iron and steel, cotton goods, and slaughtering and meat packing.

Employment. A press release from Washington indicates that in June the tide of employment turned and that there was a small decrease in the nation as a whole. Thirty-one industrial centers reported increased employment, and thirty-three reported a decrease. A large majority of the centers reporting increased employment were in the Middle West and South, while practically all the decreases occurred in the Northeast. The greatest declines in employment occurred in the following industries: paper and printing; land transportation vehicles; stone, clay, and glass; textiles; non-ferrous metals; and lumber. The largest increase in employment occurred in leather and its products, beverages, and foods.

Conclusions. The government statement says:

"The slight decline in employment reported in paper and printing, textiles and their products, and chemicals and allied products, is purely seasonal. The shading down of employment in vehicles for land transportation, metal, and



Source, Bureau of Labor Statistics

Fig. 17 TREND OF EMPLOYMENT AND EARNINGS, MAY 1923

metal products other than iron and steel, and iron and steel and their products, reflects a healthy condition in these particular industries and places them on a more substantial basis, indicating enduring permanency."

Immigration and Emigration

No new data concerning migration have become available since the last issue, which leaves April as the latest month covered.[1] The indications are that there is a considerable increase in immigration going on, which will help to relieve such labor shortage as there is.

[1] See MANAGEMENT AND ADMINISTRATION, July 1923. Fig. 18. P. 97.

CURRENT BOOK REVIEWS

Guarding the Dollar's Purchasing Power

MONEY. *By William Trufant Foster and Waddill Catchings. 409 pp. Houghton Mifflin Company.*

REVIEWED BY CARL SNYDER
Chief Statistician, Federal Reserve Bank, New York

THIS is a very timely, entertaining, and useful book that should enjoy wide popularity. "The money fallacy," the authors quote from Simon Newcomb, writing forty years ago, "is periodic, overwhelming us, not at regular intervals, but from time to time, owing to the influence of changing events. The Americans, more than any other people, have been its victims." What Simon Newcomb did so well in the days of the "greenback" mania and Ben Butler and James B. Weaver; what George E. Roberts and others did in the days of the "free silver" craze, and Bryan and "Coin's Financial School;" this book does with like effectiveness for all the schemes of the Edisons, Fords, Loucks and Ladds in this country, and the Major Douglases and Hobsons in England; for the mental unrest which the great upheaval of prices in the last few years has brought has not been confined to this country.

It is an unusual thing that a former college president and a prominent industrialist should join forces to write such a book. This collaboration is part of the program of the new Pollak Foundation for Economic Research, of which Dr. Foster is the head, and in which Mr. Catchings is deeply interested. They have written no dry-as-dust treatise, but a practical, readable, and quite up-to-the-minute book. It should be extremely useful to business men, students, and legislators who would like to have, in a language which they can fully understand, and with a wealth of apposite illustration, a careful, candid, intelligent discussion of all the proposals like those of Messrs. Edison and Ford, or of Douglas and Hobson, to institute a new money economy and inaugurate the millenium with newly printed money.

Not that there is anything new in these proposals. They are nearly as old as the days when the Massachusetts Bay Colony gained dubious fame by inventing for the world the scheme of irredeemable paper money; nothing new but the labels. They are just the same old fiat money phantoms in some new garb or guise. Nor is there a great deal new that can be said in the arguments against them; which means also that there is not much new in monetary theory, save what we have been gaining within the last few years of statistical proof, and from the almost unparalleled experience of the World War, which for the economist was a kind of wonderful chemical laboratory wherein each test tube represented a nation, and a given amount of the fatal ingredient, which was fiat money, produced an almost exactly calculable and anticipatable effect.

More than a hundred years ago David Ricardo, looked upon today as practically the founder of the modern theory of money and prices, put at the head of the chapter on this subject in his "Principles":

> So much has already been written on currency, that of those who give their attention to such subjects, none but the prejudiced are ignorant of its true principles. I shall, therefore, take only a brief survey of some of the general laws which regulate its quantity and value.

As one reads this new book one wonders whether England, the parent of political economy, or America, its offspring, has gained very much in this century in popular understanding of economics.

In this book there are very lucid chapters on "Money as a Central Interest in Life," as "A Medium of Exchange," as "A Standard of Value," on "Money and Inflation," "Money as Suspended Purchasing Power," "Money in Relation to Goods," to "Production and Consumption," and to "Costs and Profits."

It is all in plain language, and not in that of the theorists or the erudite. The writers have read widely and garnered carefully. There is an abundance of telling quotation, all the way from keen old Pelatiah Webster, father of American economists and a born statistician to boot. There is an equal abundance of homely argument as, for example, the reply to many estimable people who are worried because the United States should have locked up in its coffers three billions of idle gold. Of course it is not idle at all, but the authors observe that the cost of the care of the whole of it would not compare with the nation's bill for chewing gum. That is the sort of sanity that is sadly needed these days.

There is much keen observation, as, for example, a thoughtful page on the idea that the depression of 1920 was not due to a "buyers' strike." If there was any strike of this kind it was the fright of the buyers for the retail stores and others who found themselves getting unexpectedly full supplies on their orders and a consequent overplus of goods.

The authors point out aptly that the gold standard is a monetary standard and not a "standard of purchasing power;" and that what is called "sound money" is not needfully a stable money, although a stable currency is assuredly sound money. More than 60 years ago Jevons proved conclusively that the value of gold in purchasing power could vary widely; even in peace times it varied by as much as 50 per cent between the years of 1897 and 1912, for example, to say nothing of its enormous variation in value in the last three years.

The gold standard is extremely convenient for business men and bankers in their current transactions, but it does not insure justice to debtor or creditor, or to the working man who puts the slender savings of a lifetime into a bond, or a mortgage. It may be almost as ruthless in its confiscatory effects as all but the worst of irredeemable paper currencies.

In sum, this book represents the best and soundest economic thought of the present day, and is an admirable popular exposition of the fundamental ideas and aims of the new National Monetary Association, "organized to safeguard the purchasing power of the dollar," in which Dr. Foster and Mr. Catchings are both deeply interested. It seems clearly established that there are few more powerful factors making for social disturbance, unrest, and discontent, and every variety of economic and social nostrum than a money of uncertain and widely variable purchasing power, especially when this variation takes the form of currency or credit inflation, to the upsetting of contracts, wage agreements, and current standards of living. The minds of men cannot adjust thus easily to this kind of upset; the disturbance is really profound.

Lenin is reported to have said that "the surest way to destroy the present industrial order is to debauch the currency;" and it seems clear that unless we can get some kind of effective control of the credit mechanism, and of price levels, this country will continue the prey of recurrent waves of greenbackism and populism, and free silver, and Fordism and all its kind. This is why sound, excellently written expositions of the subject, such as these writers have given us, should be of far-reaching educational value and social service.

Economic Evolution in America

INDUSTRIAL HISTORY OF THE UNITED STATES. By *Edward S. Cowdrick. 414 pp. The Ronald Press Company.*

REVIEWED BY FELIX FLÜGEL
Assistant Professor of Economics, University of California

A FULL appreciation of the present industrial system requires a substantial knowledge of the foundation upon which this system is built. To the mind preoccupied with the burden of acquiring the necessaries of life the study of history seems at best a useless expenditure of time. But one whose vision is not obstructed by petty details, will without question fully appreciate the true significance of the "majestic sweep of progress" as pictured in economic evolution.

Mr. Cowdrick, in his "Industrial History of the United States," stresses the value of a knowledge of economic history, and in his introduction comments upon the oft-repeated query, "Why study history?" in the following words:

> The answer is to be found by explaining the utility of historical study of whatever type. It is not for reasons of academic curiosity that military men pore over the charts illustrating the battles of Napoleon. It is not for mere mental diversion that practical statesmen delve into the records of the constitutional reasoning of Chief Justice Marshall. History is of service mainly—one is tempted to say solely—as it lends aid in solving the problems of the present time.

The author recognizes three essential factors in economic development: first, the purely physical forces which have been responsible for the exploitation of the natural resources at man's disposal. This leads to a discussion of the overwhelming changes in the field of production, notably the harnessing of resources, once latent, for the purpose of sustaining life. Second, the intellectual forces applied to the perfection of industrial technique and organization generally. Commenting upon this phase of the problem the author points out that a remarkable change has taken place in both the type of intellect and the general attitude of the public toward business. Whereas at one time "business" was looked upon as beneath the dignity of a "gentleman," this contempt for the material aspects of life has been changed to one of wholesome respect and hence has called into the ranks of business the most capable men the nation produces. Third, the steady gain in ethical conceptions, particularly those relating to business, which should arouse the enthusiasm of the most persistent pessimist.

Following this introduction the author proceeds with the main theme of his volume; the history of the industrial progress of the United States. Mr. Cowdrick has departed somewhat from the usual arrangement of the subject matter. He divides his book into three parts. Part I is entitled "Before America Became a Nation," and describes the various factors which led to the exploration and colonization of America, the economic organization of the colonies, and the Revolutionary War. Part II considers "The Nation in Its Formative Period," and carries the narrative to the conclusion of the Civil War. In general the subject matter of this section is well treated, although a subdivision of the period under discussion might have been desirable. Omission of a full interpretation and analysis of the crisis of 1819 should be mentioned. While the crisis of 1837 was far more serious than the crisis which followed the financial panic of 1819, the latter had a noticeable influence on economic conditions and should not have been omitted from the discussion.

Part III describes "The United States as a Dominant Industrial Power." To this period, beginning with the problems of reconstruction following the Civil War and ending in very recent times, the author devotes over one-half of the entire volume. Every important phase of our economic history is treated with sufficient detail to give the reader an understanding of the dominant forces which have shaped the present gigantic industrial structure upon which the prosperity of the United States depends. As separate units the chapters are well presented, but in the arrangement of the subject matter as a whole some changes might be suggested. For example, Chapter XXX, dealing with the United States Steel Corporation, should, in the opinion of the reviewer, have been included in the preceding chapter, which describes large-scale production. The chapters relating to the period of the World War, while short, are nevertheless an excellent synopsis of the economic phases of that epoch-making period.

While the index is not completely adequate, and there is an insufficiency of charts and maps, Mr. Cowdrick's volume can be used to advantage as a text. To the business man desiring a general knowledge of the economic evolution of the United States it can also be recommended.

Will Equalized Incomes End Unemployment?

THE ECONOMICS OF UNEMPLOYMENT. *By J. A. Hobson. 157 pp. The Macmillan Company.*

REVIEWED BY RUDOLPH M. BINDER
Professor of Sociology, New York University

PROFESSOR HOBSON has given us another notable book—clear, concise, authoritative. The last of the three adjectives may be questioned by many of the old-fashioned economists and business men. The orthodox economists have well-nigh persuaded the world that there is an inevitableness and an immutability about economic laws such as naturalists have made us believe exist concerning the laws of nature. Business men have eagerly accepted that view, and have lived up to it to the greatest possible extent consistent with their own advantage.

Now comes a recognized authority on economics with the frank statement and ample proofs that much, if not all of the assumed infallibility and immutability of economic laws, is a mere fiction of an older generation. The so-called iron law of wages goes by the board, and prices, unlike tides, are shown *to be raised* and not to rise. In other words, they are manipulated and follow no inevitable law—human, natural, or divine. While the author deals only with the one problem of unemployment, its ramifications lead to the discussion of "A Limited Market," "The Failure of Consumption," "The Balance of Spending and Saving," "The Psychology of Trade Fluctuations," "Surplus Income as the Cause of Fluctuations," "Wage Reduction as the Remedy for Depression," "Credit as a Factor in Fluctuations," "The Douglas Theory," and "Replies to Criticism."

Professor Hobson's fundamental theory is that the great disparity of income causes all our cyclical depressions in finance and industry, and consequently most of the irregularity of employment. How can that be?

The income of the rich, both earned and unearned, is so large that they cannot spend it on their own wants. Hence they save considerable sums and seek new investments for their surplus. Keen competition between different capitalists furnishes ample testimony to the anxiety of these people to invest their large savings. What happens? Production of goods is likely to outrun consumption, and we have the periodic gluts and stoppages with later underproduction and unemployment. Experience has taught both workers and employers that these depressions will happen, and both resort to restriction of output by ca'canny and monopolies, respectively. No one is able, though, to calculate accurately, and overproduction will happen periodically. The artificial restriction of output will, moreover, raise prices and invite new capital into profitable investments. At times of rising prices banks eagerly extend credit for capital investment, only to recall loans when production has reached proportions where consumption cannot absorb the goods produced. Various factors combine in this manner to produce the ups and downs of business cycles. Where lies the cure?

A more equal distribution of income would obviate the excessive savings of the rich with their demand for capital investment. Demand for consumption goods would be more constant because more evenly distributed. Production and consumption would keep at a more even pace, and employment would be practically continuous. This would incidentally avoid a large amount of waste both from unemployed capital and from labor. Socially, the advantages would be greater still, since the workers would be enabled to raise their standard of living, keep the demand for staple articles steady, and, above all, remove the bane of the fear of unemployment which prevents the modern laborer from taking his right place in society. Much if not all of the restlessness among the workers would disappear and they would no longer listen to subversive theories.

But, how would savings take place under these circumstances? How could new capital be procured for the further expansion of wants? Does not every rapid raise of wages testify to the thriftlessness of the workers?

The laborers, being assured a steady income, will cease spending like the proverbial sailor. They will save and become more like the professional men who, on comparatively small incomes, manage not only to live decently but to save small amounts for the future. This change in the psychology of manual workers from the uncertainty of earnings and consequent periodic "flings" at times of affluence, will be one of the most important benefits of the new plan. The savings of the many will in the aggregate surpass the amount saved at present by the rich. There will thus be plenty of new capital for the further expansion of wants.

But again, is this not socialism or communism? Not by any means. Professor Hobson advocates a more equitable, not an equal, distribution of income. There will always be some incentive for the more enterprising, especially if business should adopt what the reviewer has called "the professional attitude of business for service."

It is undeniable that the tendency of modern times is along these lines. The graded income tax, the more numerous undertakings of the state for health, education, various forms of insurance, etc., are certainly steps toward equalizing incomes.

For Better Health Standards

HEALTH BUILDING AND LIFE EXTENSION. *By Eugene Lyman Fisk, M.D., xvi, 521 pp. The Macmillan Company.*

REVIEWED BY ROBERT S. QUINBY, M.D.
Hood Rubber Company

IN this volume entitled "Health Building and Life Extension," prepared in collaboration with the Federated Engineering Societies, Dr. Fisk plainly states the present-day health problem, outlines various factors constituting it, and offers constructive remedial measures directed toward its solution.

"Man is far below a reasonable standard of animal excellence," he says, and substantiates this statement by exhaustive statistics gathered from physical examination records during the war as well as morbidity and mortality statistics from authoritative sources.

He points out the dangers of complacency as a result of the apparently reduced death rates, stating that while marked reductions have been made through the successful combating of certain contagious and infectious diseases, particularly among young age groups, yet there appears an ever-increasing incidence of degenerative diseases among the more advanced age groups. This condition has a definite economic bearing in that the period of highest productivity of the race is not only becoming reduced, but also is interrupted by the incidence of disease during the mature years when man, as a result of accumulated experience and knowledge, should be able to contribute most.

According to the estimates of the Committee on Waste in Industry of the Federated American Engineering Societies, upwards of 80 days per year is lost on account of sickness among industrial workers. Experience indicates that this sickness rate increases quite rapidly after the age of 40 years has been reached.

Careful consideration is given to a number of factors, such as heredity, infections, nutrition, physical and mental strain, etc., which contribute both towards a high morbidity and mortality incidence.

In offering a constructive remedial program, Dr. Fisk suggests, as the proper central source, the creation of a Cabinet Secretaryship of Health, directing national and international health problems, and likewise co-ordinating through the State Health Departments the different factors of community, industrial, and other health programs. He lays particular stress on the widespread application of physical examination as the foundation of all constructive health work and based on these findings the institution of proper remedial measures.

The book is commended to those interested in matters of health, particularly to those dealing with groups of individuals in communities, factories, or elsewhere, and will act both as an inspiration to create higher health standards as well as offering a valuable book of reference on many health subjects.

Foundations of Internal Finance

CONTROLLING THE FINANCES OF A BUSINESS. *By James O. McKinsey and Stuart P. Meech. 638 pp. The Ronald Press Company.*

REVIEWED BY JOHN T. MADDEN
Assistant Dean, New York University School of Commerce, Accounts and Finance

FOR many years the emphasis in management has been on the side of production. The shortage of goods during the war period accentuated that well-developed tendency. The period of deflation brought home to many who had never thought seriously about the matter before, the importance of a better control of financial requirements as well as the need of devoting more attention to the problem of distribution. For this reason, the present volume will probably receive a better reception than it would have enjoyed at an earlier period when the problem of financial control was not so vital, and when business men and others were not willing to devote much thought or attention to this phase of management. Bankers encouraged business men in some instances to borrow freely and without due regard to the inevitable day of reckoning that had to come sooner or later.

This attitude of mind on the part of the banker was well illustrated by the experience of one banker more far-sighted than his confreres who called a meeting for the purpose of proposing an orderly liquidation of customers' loans in a special line of business. He mentioned several cases that were typical in which two or more acceptances were at that moment in the portfolios of the banks on one lot of commodities. The goods had passed from hand to hand in exchange for an acceptance, each sale being made at a price advance, and as long as the price level continued to rise the process would be repeated. Our banker was not very successful in his purpose; he was called an alarmist and it was even intimated that his motives might be questioned. While he did not secure the co-operation that he hoped for, he proceeded nevertheless to arrange for an orderly liquidation of the paper of his own customers in this line. As a result of this policy, his borrowers avoided the losses that would have been sustained by them otherwise while the losses of the bank were negligible.

Part I contains three chapters devoted to a discussion of the background of financial administration. The authors explain the phenomena of the business cycle in clear and non-technical language. They are to be commended for their caution to the reader not to take the conclusions of professional forecasters too seriously. Business is not yet an exact science and the tendency upon the part of business men to regard too highly the pronouncements of some of the professional gentry who are becoming quite prosperous in selling these services is regrettable. Forecasts have their useful and legitimate field and are of value in certain directions, but the careless use of mass data and the impossibility of forecasting the behavior psychology of the hundred million people who make up these United States are factors that must be reckoned with.

The procedure for determining the capital requirements of a business is taken up in Part II. Those who are familiar with Professor McKinsey's book on budgetary control will recognize a certain amount of duplication in this section as well as in other places in the volume. The inclusion of this duplicate material is dictated undoubtedly by the desire of the authors to round out the subject matter. Mention is made of the desirability of a short-time lease of plant and equipment as an alternative to plant construction when the peak of prosperity is approaching. If such arrangements can be made, they are, of course, indicated by all the rules of sound finance, but it should be pointed out that this is just the time when landlords are insisting on long-term leases and equipment can be purchased only with difficulty and delay, to say nothing of securing equipment by lease. It requires will-power, which few men possess, not to expand when profits are so alluring and appear so easy of attainment. If the manager restrains himself and does not yield to the temptation to expand unduly, he makes less money during the height of prosperity, but on the other hand he will not lose money during the period of deflation which follows.

Part III concerns itself with the sources of and devices for securing capital. This section as well as Part IV on "Marketing Securities" follows the conventional treatment given to these topics. The order and arrangement of the material and the presentation of the subject matter are well done even though most of it is familiar to the experienced financial administrator. After reading the chapter on selling securities direct to the investor, I understand why it is that I am on the "sucker list" of all the newly organized oil and mining companies that spring up, because the authors state that in securing prospects "a list of the faculty members of institutions of learning may be obtained from the published bulletins."

Part V reviews the subject of the control of capital disbursements and in this section the authors have made free use of the volume on budgetary control referred to above. Control of credit is discussed in Part VI. The authors emphasize the functions of the credit department in furnishing business and technical advice to customers. The increased volume of business of many concerns is often due to an enlightened credit man whose conception of his relation to the development of the business differs greatly from that of his prototype of a decade ago.

The volume concludes with Part VII, four chapters on the control of income, and Part VIII, four chapters on the organization for financial administration. The first-mentioned section treats of the legal and accounting phases of profit determination; the purposes and uses of funds and reserves; dividends and dividend policies and the management of surplus. These important topics are handled from the business man's point of view and are well written.

Throughout the book the relation of the business cycle to the problem of financial administration is stressed. Perhaps it may be well to offer a word of caution in view of the increasing interest in the business cycle about which we hear so much in these days. Some one once said that foresight was a great deal better than hindsight. It is very easy to determine what section of the cycle we were in after the event. How is the perplexed business man to know in what part of the cycle he is today? Despite our present knowledge and improved statistics business men must gamble. We are far from the stage of removing speculation from business and I suspect that if we ever reach that stage most of the fun which a business man gets out of the game will disappear. A chart constructed from mass data may be very misleading if used in connection with a special line of activity. When business men are able to secure production, distribution and inventory statistics of all competing concerns in their respective businesses, we shall have made a beginning in the direction of scientific forecasting. There is no reason why trade associations may not gather for their own industries the same information which the federal government assembles for the growers of grain and cotton. The difficulties of controlling the finances of a business under these conditions will be materially reduced.

Writing Business Letters

THE HANDBOOK OF BUSINESS CORRESPONDENCE. By S. Roland Hall. [illegible] pp. McGraw-Hill Book Company.

REVIEWED BY EDW[illegible] J. K[illegible]

[illegible] Department of Business [illegible], New York University School of Commerce, [illegible] Finance

THIS is to be an enthusiastic and laudatory review of an important business book. Lest the statements of the reviewer read like a publisher's "blurb," let it be known at the outset that the reviewer is himself the author of what he should like to have considered competing books.

"The Handbook of Business Correspondence," by S. Roland Hall, is described on its title page as "A reference work covering the principles and practice of letter writing for business purposes." The reviewer would describe it as not only the most complete compendium of information about business letter writing but also one of the most thorough pieces of work on this subject that the reviewer has seen during the 12 or so years that he has specialized in this field. Practically no detail regarding the preparation and writing of business letters has escaped. Mr. Hall is indeed to be congratulated upon the completion of this exhaustive volume of more than 1000 pages.

Mr. Hall is well qualified to write authoritatively on business letter writing. Formerly director of the International Correspondence Schools of Advertising and Salesmanship, sometime advertising manager of the Victor Talking Machine Company and of the Alpha Portland Cement Company, and now advertising counselor, he has had long experience with business letter writing in its various phases. In view of this practical experience, it goes without saying that Mr. Hall's treatment of the subject is sound throughout.

In "The Handbook of Business Correspondence," the author discusses the writing and use of practically every important type of business letter. The wide variety of the types treated is indicated by the following chapter heads:

"Letters That Sell."	"Letters to Salesmen."
"Letters That Adjust."	"Letters to the Trade."
"Letters That Collect."	"Letters to Women."
"Letters About Credit."	"Letters to Farmers."
"Developing Export Trade by Correspondence."	

In addition to giving instruction in the art of writing effective business letters, Mr. Hall sets forth detailed information regarding such related matters as Correspondence Supervision and Improvement, Organization of a Mail Sales Division, Mailing Lists, Management of a Stenographic Department, Records and Work Methods, Printed and Processed Letters, and Better English.

Since Mr. Hall's experience has been so largely in the field of advertising and selling, it is only to be expected that the strongest section of his book is that dealing with the construction and use of sales letters. Here he analyzes the sales letters of many well-known business houses and points out their good or bad features. He not only indicates the faults; he rewrites the inefficient passages to show how they can be improved. And he succeeds in most cases in convincing the reader that his analysis is correct.

Of particular interest are the statements of the results secured from some of the sales letters, follow-up sales letter systems, and promotion letters that are shown. The following excerpt will indicate how specific are some of the instances quoted by Mr. Hall:

> Mr. Leon A. Soper gives this interesting information about how mailing lists were made up and the results from the use of the solicitation:
>
> I am sending you a copy of one of our most recent form letters, which was used to advertise our new "Seventy Special" policy. In connection with a sales contest held last October, we announced that we would send the Seventy Special letter to fifty "hand-picked" names submitted by each salesman.
>
> There were 13,073 names received. The letters were mailed and return postage was provided on the return envelope. (This is the general rule with us.) Thirty-three per cent, or a little over 4000 inquiry cards were returned completed with date of birth, etc., and up to the present writing \$800,000 of new business has been traced to the cards. This "inventory" covers a period of three months, and augurs well for the amount of total sales we shall trace to this particular lot of circularizing at the end of the year, because with less than two-thirds of the number of leads mentioned in our sales inventory chart, our experience at the end of the third period (90 days) shows a gain of a little over 20 per cent in volume of sales.
>
> If this rate of increased sales is maintained throughout the 12 months, the total sales from this particular lot of leads will pass the \$2,000,000 mark. This would mean that each inquiry secured for our salesmen was worth an average of \$8 in commission.

"The Handbook of Business Correspondence" is well done in every way, both by the author and by the publisher—it is written in a clear, incisive style, its typography is beyond reproach, and its general format is business-like. To repeat, this is an important book in the field of business letter writing. As such, it should be in the business library of every business man. More than that, every business man should read it, for he will find that the time spent in consulting it will be repaid to him many times.

Two Views of Exporting and Importing

TECHNICAL PROCEDURE IN EXPORTING AND IMPORTING. *By Morris S. Rosenthal. 312 pp. McGraw-Hill Book Company.*

FINANCING IMPORTS AND EXPORTS. *By Allan B. Cook, 218 pp. The Ronald Press Company.*

REVIEWED BY IRA B. CROSS
Professor of Economics, University of California

THE first-named volume is, as its title denotes, a discussion of the technical details of exporting and importing. As manager of the export department of Stein Hall and Company, Inc., Mr. Rosenthal has had intimate contact with those things of which he has written. The volume is truly a practical book by a practical man, and will prove to be extremely helpful and suggestive to those engaged in foreign trade.

The five parts, of about 60 pages each, deal respectively with the details of the export shipment itself, domestic and foreign custom procedure, packing for export, marine insurance, and financing the shipment. Examples of actual transactions are frequently included, and intimate directions are given. The rights and duties of all parties concerned are discussed from a legal as well as from a practical point of view.

In writing on the financing of exports and imports Mr. Cook has brought to his task a rare combination of experiences. He is at present Assistant Secretary of the Asia Banking Corporation of New York, and lecturer in Foreign Exchange at New York University. He has also been associated with various manufacturing and exporting concerns. The qualities of a practical business man and those of a successful university professor have enabled him to prepare a volume which is both simple and clear and which contains an analytical and suggestive treatment of a subject which is almost always handled in a confused and technical manner.

Mr. Cook presents the financing of foreign trade as a mercantile and banking problem. Authors usually stress only the latter point of view.

The first few chapters are devoted to elementary phases of the question, such as the definitions of certain technical details, the supply of and the demand for exchange, exchange rates, discount markets, and monetary standards. The author then proceeds to discuss the details and the various uses of import and export letters of credit, the acceptance credit, and certain related topics. An excellent chapter is devoted to a comparison of the advantages of dollar credits as opposed to sterling credits. The author is of the opinion that while in the future, as never before, both kinds of credit will figure strong as competitors, it will be the successful handling of the discount rate by the authorities controlling it that will largely determine the outcome during the next few years.

Mr. Cook is an ardent advocate of the extension of American banks in foreign countries through the establishment of branches, and declares that the "branch bank is the trade outpost, jealously guarding the interest of its home land." He writes as one who is vitally concerned with preparing the American exporter to enter and to remain in the field of foreign trade as a successful competitor of foreign merchants. He realizes as do all those who have had contact with such matters that our merchants cannot hope to retain the trade which was theirs during the Great War unless they adopt the tactics, and are equipped with the knowledge, characteristic of foreign merchants.

Both of these volumes are excellently arranged, simply written, and filled with an abundance of practical and valuable hints for the exporter which should enable our merchants, if they but follow the advice given, to avoid many of the dangerous pitfalls which usually beset newcomers in the field of foreign trade.

Business English for the Executive

ENGLISH MANUAL FOR BUSINESS. *By Robert Winternitz, with the collaboration of Paul T. Cherington 96 pp. A. W. Shaw Company*

REVIEWED BY THOMAS B. STANLEY
Assistant Professor of Business English, New York University School of Commerce, Accounts and Finance

NOTHING is more irritating than a formal introduction of two or three paragraphs when the subject is so simple that there is really nothing to introduce; and the same is true of the painful, meticulous summary of points made in a passage that is sufficiently clear to impress itself on the reader's mind without any further comment."

This thought (from the new "English Manual for Business," by Winternitz and Cherington) is not a bad starter for a review of a business book or, for that matter, for any piece of business English. Desk manuals for the business man are sufficiently familiar to require no introduction. What we wish to know about a newcomer in this field is its individual claim to our attention, and how it differs from the other books in its class.

The authors address this book particularly to the business executive. Thus limiting the scope of the manual, they make no attempt to provide an exhaustive compendium of rules, but rather try to give the executive who is anxious to improve his written English a point of departure for further study.

The outstanding difference between this book and its fellows is that its treatment is selective rather than exhaustive. The material is divided into three sections: Principles; Fundamentals; and Types of Business Writing. There is also an interesting appendix, of which more will be said.

Under the first head are discussed such matters as taking the reader's attitude into account, analyzing the subject, organizing material, and so on. Under the second head fall more technical matters such as grammar, spelling, sentence structure, and punctuation. The types of business writing treated in the third division are letters, advertising copy, and reports.

None of these subjects is exhausted, but in several of the discussions a convenient handle is given for grasping the subject as a whole, with enough illustrative material to make the treatment concrete. For example, most business men, if they ever met Professor Barrett Wendell's "English Composition," did so under duress, and proceeded cheerfully to forget it soon afterward. To these, the excellent "method of attack" for organizing material into business reports, quoted on page 27 of the "Manual," will come like an old friend; and to all as a genuine help in a hard task. The lists of connectives on pages 58 to 63 will also, *if used*, be really helpful.

The appendix, comprising a little less than one-third of the book, offers a compilation of rules and data regarding the preparation of copy for the printer. It is an open question whether such material belongs in this kind of book. Nevertheless, the attempt to make one book grow where two grew before is commendable, even if not wholly successful, and the inclusion of this data may recommend the "Manual" to executives especially anxious to compress their reference material to the smallest possible bulk. The appendix gives decidedly more of a reference treatment than the body of the "Manual."

Some criticism of the book is inevitable, because it is impossible to please everybody by a selection which frankly leaves out as much as it includes. This reaction is to be discounted by the fact that a reference handbook was not intended. It is to be regretted that the title of the book is not more clearly indicative of its contents and that the section headings are not more clearly differentiated. For instance, one is struck by the fact that some of the matters discussed under "Principles" are quite as fundamental as those treated under "Fundamentals." These are of course matters of opinion, but it is worth while in dealing with a technical subject for lay readers to make the terminology as nearly mistake-proof as possible.

On the whole, there is nothing particularly new in the book, but there is a serviceable gathering of familiar material, rather courageously diverse in character, and likely to be helpful to the executive in proportion to the determination with which he builds his own structure of further study on the foundation provided.

PAPERS AND DISCUSSIONS THIRD NEW ENGLAND REGIONAL COST CONFERENCE. *16 pp. The National Association of Cost Accountants.*

ONE of the outstanding features of the work of the National Association of Cost Accountants is the large number of publications dealing with vital cost questions, which it has issued during the past few years. The latest official publication of the Association is a fine example of its policy. It contains the papers and discussions of the Third New England Regional Cost Conference, held at Hartford, Connecticut, on May 18 and 19. Three technical sessions were held dealing with the following subjects: Should Material Be Charged to Cost or Replacement Value?; To What Extent Should Foremen Be Given Cost Information?; and Budgetary Control of Manufacturing Burden. Each subject was treated thoroughly in the papers, and in the discussions which followed, the latter bringing out many points not mentioned in the papers. At the first technical session, the arguments in favor of replacement costs as opposed to actual costs, were summarized, five reasons in all for using the former being discussed. Then the arguments against the use of replacement costs were brought out, seven reasons being discussed.

There is no little talk and agitation today in favor of the managerial policy of supplying foremen with cost information. Most progressive cost men and managers believe that foremen should get cost data, but there is no unanimity of opinion as to how much information they should receive. This question was discussed in great detail. One interesting point advanced was that the tendency to take away some of the duties which foremen formerly had under the military type of management possibly had gone too far; that foremen ought to have a lot to say about the planning of work and should have a vital part in controlling production in their departments. This is a stimulating thought, worthy of the serious consideration of managers and cost men. Prior to the days of F. W. Taylor, sometimes referred to as the father of scientific management, the foreman was supposed to have too many duties and was "Jack of all trades and master of none." Taylor, his followers, and other industrial engineers have advocated a rather distinct separation of planning and performance which resulted in the foreman being relieved of many duties that he formerly had. Now there is a noticeable feeling in some quarters that possibly this development has been carried too far.

All material on budgets is examined today with great care because not very much, comparatively, has been written about this vital subject. At the technical session on this subject, the theory of the budgetary control of manufacturing burden was clearly expounded and an actual example of how it is done in industry was brought out.

Cost men and managers will find this latest publication of the National Association of Cost Accountants a valuable document, for it is full of usable information.

PENSIONS FOR INDUSTRIAL AND COMMERCIAL EMPLOYEES. *24 pp. American Management Association.*

DISCIPLINE AND ITS MAINTENANCE. *14 pp. American Management Association.*

THE first of these special reports of the American Management Association, successor to the National Personnel Association, reconsiders the pension problem in the light of the most recent developments in the field of industrial relations, as well as from the point of view of the cost which a pension plan involves. In the preparation of the report the Association had the co-operation of many of its member companies, and the special help of a number of specialists, including C. R. Dooley and C. J. Hicks, of the Standard Oil Company of New Jersey; Bruce Haynes and Henry C. Link, Industrial Relations Department, United States Rubber Company; and Harry A. Hopf.

After defining the term "pension" and outlining the growth of pension plans, the report indicates the motives for installing pension systems and the special features of certain definite plans. It then takes up the estimating of pension costs, plans for meeting them, and the employees' attitude, concluding with an appendix giving a bibliography and a list of 157 concerns which maintain pension systems. Altogether the report serves a valuable purpose in stimulating thought, and calling the attention of industrial executives to certain points concerning pension plans which may have been overlooked.

The second special report begins with the statement that the maintenance of discipline consists of the establishment of standards of behavior, the training of workers to conform to these standards, the determination of offenses and the infliction of penalties for transgressions of the established rules.

Discipline is characterized as being of two types. The first is self-imposed and therefore most important and effective in management. It aims at freedom for development of all that is best in the individual's personality through education and creation of interest in the job. The second kind of discipline assumes that the worker needs to be bossed, that he must be prevented from injuring himself, and that punishment is the principal means by which this may be accomplished. The authors of the report go on record as believing that the plant which is self-disciplinary is best managed.

Methods of maintaining disciplinary control are outlined under the heads of training, rules, supervision, publicity, and penalties. Under "Right and Wrong Methods" two wall notices are contrasted. The first reads "Anyone who marks these walls will be discharged and prosecuted to the fullest extent of the law." The other says simply this: "Our employees will aid us in keeping these walls clean." In a certain plant the first notice resulted in increased wall-writing, but after the second notice was substituted therefor, not a single mark was made on the wall.

The second report does not show quite as careful preparation, mechanically, as the first, but that does not alter the fact that both are of undoubted value to progressive industrial executives.

PRINCIPLES AND PRACTICE OF UP-KEEP PAINTING. *Prepared and published by E. I. duPont de Nemours and Co., Inc.*

A BOOK well printed and bound in fabrikoid to advertise the large assortments of paints and varnishes manufactured by its publishers. The announced purpose of the volume is to serve as "a practical aid to plant superintendents or others responsible for the maintenance of indnstrial property and equipment and to architects and engineers in the protection of new construction. It covers in simple, practical fashion modern painting practice for all types of exterior and interior surfaces." Although its purpose is frankly to advertise the products of its publishers the book is of unquestioned value as a manual of information to anyone interested in the use of paint and varnish as preservatives for wood and metal surfaces. A single copy of the book is sent without cost to executives, plant managers, etc., who make application. A charge is made for additional copies. The book is well worth its price to anyone interested in up-keep painting.

CROWELL'S DICTIONARY OF BUSINESS AND FINANCE. *viii, 608 pp. Thomas Y. Crowell Company.*

AMBITION and no little courage are apparent in this attempt to present in a single volume of about 600 pages "all important terms used in business and finance generally." In the main, it must be said that the courage availed. The result is a really valnable deskbook, well printed and bound and not unwieldy in size.

This is, of course, the work of many authors and authorities, most of whom are mentioned in a bibliography at the end of the volume. Incidentally, by the accident of alphabetical arrangement, *Administration* tops the list of authorities acknowledged in the preface. Mr. Henry Ware Jones, author of "Safe and Unsafe Democracy," supplied the legal terms. Through the courtesy of Moody's investors' service it was possible to make use of much valuable material contained in "Smith's Financial Dictionary," which was highly regarded in its day, but is now out of print.

The appendix carries, in comparatively few pages, a large amount of useful matter. This includes a statement of the Monetary System of the United States, compiled by the Director of the Mint; a digest of postal information; calendar of legal holidays; a limitations table; interest and income tables; tables of weights and measures and a well-selected list of signs and abbreviations sanctioned by general usage.

EMPLOYEE VACATION PLANS. *A survey by Industrial Relations, (Bloomfield's "Labor Digest"). 23 pp. Bloomfield and Bloomfield.*

THIS report, covering the details of 121 different plans for employee vacations, will be found valuable by executives who wish to follow the latest developments in management practice concerning vacations in various fields of business and industry. It answers such questions as these: Are employee vacations with pay desirable? How long should vacations be? When should they be given, and under what conditions? What regulations should govern them? What concerns give winter vacations? What is the best vacation plan for executives?

The chief reasons advanced for vacations with pay for employees are these:

1. They serve to reward faithful service and steady attendance.
2. The change of one or two weeks from daily routine is beneficial.
3. Good-will of long-service employees is retained.
4. Labor turnover is reduced.
5. Efficiency is increased.
6. Regular attendance is stimulated.
7. Lost-time records are improved.
8. Plants are enabled to shut down during slack seasons and make necessary repairs while the workers are resting.

SCIENTIFIC ADVERTISING. *By Claude C. Hopkins. iv, 102 pp. Lord and Thomas.*

THE author of this attractive little book claims what would seem to be a world's record in the advertising business. He asserts that he has been 70 years on the job. While the time measures but 35 years by the calendar, he figures that by working two shifts most of the time he has lived two years in one. In any event, Mr. Hopkins has the distinction of being president of one of the largest and oldest advertising agencies in the world, and it does not become his juniors to question his statistics.

In 21 short chapters this dean of advertising specialists offers more sound sense and apt illustration than are found in many books that weigh three or four times as much on the postal scales. His chapter headings are admirably chosen. They include "Offer Service," "Tell Your Full Story," "Things Too Costly," "Getting Distribution," "Test Campaigns," "Leaning on Dealers," and "Negative Advertising."

INSTALLMENT SALES AND COLLECTIONS. *By Bryant W. Griffin. xiv, 205 pp. Prentice Hall, Inc.*

THE content of this volume is far more engaging than the form. It gives the impression of a book printed in a hurry, and without any great amount of careful supervision. The illustrations are few and badly chosen. The first one, facing the title page, shows a gentleman with a brief-case stepping into an envelope. Another, with the label "Has Your Letter a Firm Grip?" reproduces a letter whose grip appears to be anything but firm. Saddest of all is the author's dedication "to my darling little boy," in 9-point caps. It is unfortunate that these weird manifestations, which indicate a deep-seated lack of craftsmanship, are allowed to mar what might have been made an attractive as well as a useful book.

Mr. Griffin, who is manager of one of the departments of the Gotham National Bank of New York, was formerly collection manager for the Guaranty Banking Corporation of Chicago. In spite of his fondness for funny stories and his inaccuracy in quoting from the classics, he succeeds in assembling in this book a considerable amount of valuable material on installment sales and collections. One of the most useful chapters is the sixteenth, which gives a digest of the laws of the various states on contracts of conditional sales, and on chattel mortgages.

PULLING TOGETHER. *By John T. Broderick. v, 167 pp. Robson and Adee.*

THIS sixth edition of one of the most widely read books of the day on human relations in industry contains a considerable amount of new material, including a short sequel under the caption "Untouched Wealth." As Dr. Steinmetz indicates in his brief but pointed introduction, the great problem of the industrial world today is that of conciliation and co-operation. In this narrative, called "Pulling Together," Mr. Broderick gives a clear exposition and discussion of a plan which in one form or another is rapidly growing in favor, and in many instances where it has been honestly tried has led to increased co-operation.

The spirit and scope of the book are revealed in some of the chapter headings, such as "Mutuality of Interest," "Collective Bargaining," "How Good Will Is Won," "Plan of Employee Representation," "Wages," "The Public," "Our Friends the Foremen," "Human Engineering," "Hard Times," and "Need of Strikes Outgrown."

MANAGEMENT DATA

Standardized Methods and Accepted Practice Classified for Permanent Reference

Number 17

INDUSTRIAL STANDARDS IN THE UNITED STATES (Continued)[1]

THE data presented in this compilation is a listing of industrial or operating standards, as distinguished from dimensional standards. It covers classifications, codes—building, installation, test, operating, sanitary, safety, fire protection—specifications other than purely dimensional, standards of procedure, etc. The information was obtained from the trade and technical associations, and from the comprehensive files of the American Engineering Standards Committee. For each standard there is given the name, sponsor, concurring associations, dates of issue and revision, and a brief outline of its provisions. Listing has been done under a classification following specific lines of industry, wherever possible, rather than by the nature of the standard, such as a safety, or operating, or testing standard, and the like.

ELECTRIC LIGHTING

Tentative Code of Luminaire Design.
  Illuminating Engineering Society. Sept. 1922.
    Definitions, photometry, units, symbols, etc.
Standard Specifications for Large Incandescent Electric Lamps.
  Bureau of Standards, U. S. Dept. of Commerce. (C-13) July 1921.
    Definitions, standards for tungsten and carbon lamps, testing methods, schedule of commercial ratings.

ELECTRICAL POWER

Handbook of the Electric Power Club.
  The Electric Power Club (A manufacturers' association) Mar. 1922.
    Nomenclature, standardization, operating regulations, ratings, tests, markings, symbols, etc., for equipment and apparatus.
    (See also Electrical Control Equipment.)

ELECTRICAL SAFETY

National Electric Safety Code.

Bureau of Standards, U. S. Dept. of Commerce (H-3). Oct. 1920.

Class Number
658 (003) Management Standards
62 (003) Engineering Standards

  Construction and operation of generating and substations, transmission lines, factory electrical equipment, rules of operation for employers and employees in the electrical industry.
National Electric Code.
  Associated Factory Mutual Fire Ins. Cos. 1915.
    Rules for installation and operation of light and power equipment in central stations and transformer substations.
Power Houses, Substation and Transformer Installation.
  Associated Factory Mutual Fire Ins. Cos. 1922.
    Rules for installation and operation of equipment.
    High voltage lines in industrial plant yards.

ELECTRICAL SERVICE

Standards for Electric Service.
  Bureau of Standards, U. S. Dept. of Commerce. (C-56).
    Standards of operation, and proposed rules for state and city regulation.

ELECTRICAL SYMBOLS, NOMENCLATURE, UNITS AND STANDARDS—GENERAL

Summary of Graphic Symbols for the Electrical Equipment of Buildings and Ships. (Proposal for standardization.)
  American Institute of Electrical Engineers.
  American Institute of Architects.
    The above have been appointed as sponsors by the American Engineering Standards Committee. Report submitted. (C-10). Mar. 1923.
    Symbols for systems, station, equipment, transmission lines, etc.
Electric Wire and Cable Terminology. (C-37).
  Bureau of Standards, U. S. Dept. of Commerce.

(Continued on p. 251)

[1] See MANAGEMENT AND ADMINISTRATION, July 1923, "Management Data Sheet," Number 16, pp. 113-119.

Electrical Symbols, Etc. (*Continued*)

Standard definitions of common terms.

Electrical Units and Standards

Bureau of Standards, U. S. Dept. of Commerce. (C-60).

Classification and definitions of units.

Standards of the American Institute of Electrical Engineers.

American Institute of Electrical Engineers. Rev. 1922.

Submitted to the American Engineering Standards Committee. (C-9).

Rules for formulation of standards for installation, operation and test of electrical equipment and apparatus.

Elevators

Elevator Code

American Society of Mechanical Engineers.

American Institute of Electrical Engineers.

American Institute of Architects.

Appointed by the American Engineering Standards Committee for compilation of standard. Report (A-15) not yet ready.

Engines—Internal Combustion

Test Code for Internal Combustion Engines.

American Society of Mechanical Engineers. Mar. 1923.

Methods and rules for conducting tests, quantities to be measured, presentation of results.

Engine Testing Forms.

Society of Automotive Engineers. Mar. 1917. Reprinted May 1920.

Rules and directions; specifications, log and curve sheets.

Spark Plug Test. (Recommended Practice.)

Society of Automotive Engineers. Mar. 1921.

Method of conducting operating tests.

Internal Combustion Engines—Installation and Use. (Gas, Gasoline, Kerosene, Fuel Oil.) Also Coal Gas Producers (Pressure and Suction Systems). (Also under Gas Producers.)

Regulations of National Board of Fire Underwriters.

Recommended by National Fire Protection Association. 1915. Rev. 1922.

Location, fuel supply, equipment, and operation of engines. Location, construction, and operation of gas producers.

Employment

Highway Engineering Positions—Minimum specifications. Qualifications of applicants.

American Association of Engineers. (Report of Committee) May 1923.

Skill, knowledge, and personal qualifications for each job—chainman, instrument man, chief of party, etc.

Explosives

Commercial Explosives.

National Safety Council. (Pamphlet 28.)

Best practice for elimination of accidents. Selection, storing, thawing, tamping, charging, and firing of explosives.

Explosives Safety Code

Standard authorized for development under the procedure of the American Engineering Standards Committee. (K-1) Committee not yet appointed.

(See also Storage—Explosive and inflammable materials. Transportation—Railroad.)

Fabrics and Textile Materials

Standard Methods of Testing Cotton Fabrics.

American Society for Testing Materials. (D 39-20). 1920.

Submitted for approval to American Engineering Standards Committee. (L-2).

Tentative Methods of Testing Textiles. (D 76-22 T). 1922.

Tentative Methods of Testing Cotton Fibers. (D 152-22 T). 1922.

Tentative Definitions of Terms Relating to Textile Materials. (D 123-22 T). 1922.

The American Society for Testing Materials has adopted the above.

Testing and Properties of Textile Materials.

Bureau of Standards, U. S. Dept. of Commerce. (C-41).

Standard tests for unspun fiber, yarn, thread, twine, and fabrics.

Tentative Standard Test Methods for Hair Press Cloths.

Bureau of Standards, U. S. Dept. of Commerce. (Tech. Paper No. 231). Mar. 1923.

Standard sampling and analysis procedure. Determination of percentages of oil and moisture. Recommended specifications.

Safety Code for Textile Manufacture.

National Association of Mutual Casualty Cos.

National Safety Council.

Appointed by American Engineering Standards Committee. Report (L-1) not yet submitted.

Fire Protection

Safeguarding Factory Workers from Fire.

National Fire Protection Association. 1918.

Rules for exit capacities, number of occupants permissible, construction and arrangement of stairways, etc.

Exits, Fire Alarms and Fire Drills. (No. 19).

Fire Extinguishment. (No. 24).

Fire Causes and Fire Protection. (No. 31).

Fire Brigades. (No. 36).

The National Safety Council has issued the above bulletins of recommended practice.

Mill Fire Brigades. Inspection and Care of Fire Apparatus.

Associated Factory Mutual Fire Insurance Cos. 1919.

Organization, drills, inspection of apparatus. Procedure during a fire.

(*Continued on p. 253*)

FIRE PROTECTION (*Continued*)

Suggestions for Organizing and Drilling of Private Fire Brigades.
- National Board of Fire Underwriters.
- Recommended by National Fire Protection Association. 1912.
  - Organization, alarm systems, drills, care of apparatus, co-operation with city firemen.

Installation and Use of Signaling Systems.
- National Board of Fire Underwriters Regulations.
- Recommended by National Fire Protection Association. 1920.
  - Installation, care and test of apparatus. Watchmen's time systems. Supervisory details.

Specifications for Underwriters' Steam Fire Pumps.
- Associated Factory Mutual Fire Insurance Cos. 1919.
  - Specifications, installation rules, testing.

Notes and Suggestions on Fire Pumps.
- Associated Factory Mutual Fire Insurance Cos. 1914.
  - Steam, rotary and centrifugal pumps. Recommended practice.

Specifications for Steam Pump Governors and Auxiliary Pumps.
- Associated Factory Mutual Fire Insurance Cos. 1907.
  - Installation and maintenance.

Specifications for Rotary and Centrifugal Fire Pumps.
- Associated Factory Mutual Fire Insurance Cos. 1915.
  - Specifications, installation, driving, tests, control equipment for motor drive.

Installation of Rotary and Centrifugal Fire Pumps.
- Regulations of the National Board of Fire Underwriters.
- Recommended by National Fire Protection Association. 1921.
  - Specification, installations, and tests, maintenance.
  - Includes regulations for electric drive and gasoline drive for fire pumps.

Manufacture and Installation of Steam Fire Pumps.
- Regulations of the National Board of Fire Underwriters.
- Recommended by the National Fire Protection Association and the Associated Factory Mutual Fire Insurance Cos. 1915. Rev. 1922.
  - Specifications, tests for acceptance, installation.

Installation and Use of Steam Pump Governors and Auxiliary Pumps.
- Regulations of the National Board of Fire Underwriters.
- Recommended by the National Fire Protection Association. 1908.
  - Construction, regulations for operation and installation.

Rules for Installation of Sprinkler Equipment.
- Associated Factory Mutual Fire Insurance Cos. 1921.
  - Automatic, open and window sprinklers, [illegible] supplies, general protection, [illegible] maintenance and tests.

Rules for Dry Pipe Systems of Automatic [illegible]
- Associated Factory Mutual Fire Insurance Cos. 1922.
  - General suggestions for installation and maintenance, testing directions.

Installation of Standpipe and Hose Systems.
- Regulations of the National Board of Fire Underwriters.
- Recommended by the National Fire Protection Association. 1917.
  - Size, strength, number, and location of standpipes, hose stations, nozzles, valves and fittings. Maintenance of systems. Water supplies.

Supervision and Care of Valves Controlling Water Supplies for Fire Protection.
- Regulations of the National Board of Fire Underwriters.
- Recommended by the National Fire Protection Association. 1921.
  - Approved devices, attachment and operation, classes of fire service inspection.

Gage Connections (Manometers) for Use in Testing Main Controlling Valves.
- Associated Factory Mutual Fire Insurance Cos. 1915.
  - Directions for testing.

Specifications for Valves, Indicating Posts and Hydrants.
- Associated Factory Mutual Fire Insurance Cos. 1914.
  - Specifications and methods for testing.

Care and Maintenance of Fire Protection Equipment, Including Sealing of Sprinkler Valves.
- Associated Factory Mutual Fire Insurance Cos. 1917.
  - Inspection, sealing, precautions when water supply is shut off, fire brigade.

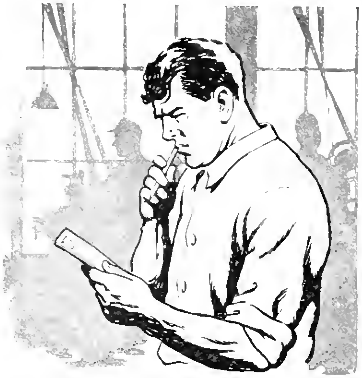
Specifications for Fire Hose, Playpipes, and Hose Houses.
- Associated Factory Mutual Fire Insurance Cos., 1911.
  - Hose specifications and tests, recommended apparatus.

Approved Fire Protection Appliances.
- Associated Factory Mutual Fire Insurance Cos., Oct. 1922. Also Suppl. of Apr. 1923.
  - List of approved devices.

Fire Extinguishing and Signaling Apparatus.
- War Department, U. S. Govt. (Purchase, Stores and Traffic Division. Cat. No. 7.) Dec. 1918.
  - Standard specification and tests for motor, hand-drawn, chemical, and hand-operated devices. Fire hose, fittings, and miscellaneous supplies.

Specifications for Fire Extinguishing Liquids (Carbon Tetrachloride Base).

(*Continued on p. 255*)



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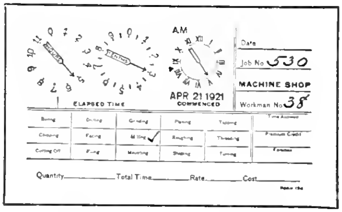

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This is the title of a booklet which contains valuable time-keeping information. Those interested in labor cost and payroll records may have a copy upon request.

CALCULAGRAPH COMPANY

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FIRE PROTECTION (*Continued*)

Bureau of Standards, U. S. Dept. of Commerce. (C-131).

U. S. Govt. Specifications for sampling and methods of test.

Standard Specifications for Cotton Rubber-lined Fire Hose.

Bureau of Standards, U. S. Dept. of Commerce. (C-111)

Specifications and standards methods of test.

Fire Tests of Materials and Construction.

American Society for Testing Materials. (C 19-18). 1918. Now under revision.

Approved by American Engineering Standards Committee as a Tentative Standard. (A-2-1919.) 1919.

(Entered also under Cement, Lime, Gypsum and Clay Products.)

Fire Hazard of Cutting Oil. (Recommended Practice.)

Associated Factory Mutual Fire Insurance Cos. 1917.

Oil-soaked floors, character of oils used, use of kerosene and emulsions, laboratory and fire tests.

(See also entries under Buildings—Fire Protection; Storage; Transportation).

FORGING

Safety Code for the Forging Industry.

National Safety Council.

American Drop Forging Institute.

(Standard has been authorized to be compiled by conferences under the procedure of the American Standards Engineering Committee.)

FOUNDRY

Foundry Safety Code.

National Founders' Association.

American Foundrymen's Association. Oct. 1917. Rev. Feb. 1921.

Adopted by the American Engineering Standards Committee as a Tentative Standard. (B-8). 1922.

Buildings, equipment, finishing and cleaning castings, protection devices, light, ventilation, first aid kits.

Fineness Test for Molding Sand. (Tentative Standard.)

Joint Committee on Molding Sand Research. 1922.

Committee made up of representatives from the American Foundrymen's Association.

National Research Council.

American Society for Testing Materials.

Bureau of Mines.

Bureau of Standards.

U. S. Geological Survey.

Procedure for sand with and without bonding substance.

Bonding or Cohesive Test for Molding Sand.

See Fineness Test — Committee above.

Tempering, methods of testing, calculation of results.

Permeability Test for Molding Sand.

See Fineness Test — Committee above.

Apparatus, principles of operation, procedure, calculation of permeability.

GAS AND GAS LIGHTING, INCLUDING ACETYLENE AND GASOLINE LIGHTING

Standards for Gas Service

Bureau of Standards, U. S. Dept. of Commerce (C-32). 1920

Recommendations for regulations affecting quality of gas, gas service, and apparatus. Suggested rules for state and city regulations of service.

Standard Methods of Gas Testing.

Bureau of Standards, U. S. Dept. of Commerce. (C-48).

Apparatus and methods, interpretation of results, determination of heating value, candlepower, purity, specific gravity and pressure.

Directions for Erecting and Operating Gas Calorimeters.

American Gas Institute. Oct. 1912.

Supplement to Report of Committee on Calorimetry. Selection of instruments, erecting and operation of calorimeters, corrections for humidity, etc.

Testing, Handling, and Minor Repairing of Dry Gas Meters.

American Gas Association, 1920.

Order of tests, testing and handling meters, tables and detailed instructions.

Installation and Use of Coal Gas Producers.

Regulations of National Board of Fire Underwriters.

Recommended by the National Fire Protection Association. 1915. Rev. 1922.

Pressure and suction systems location, construction, and operation. (Also listed under Engines—Internal Combustion, and giving instructions for the operation of such engines.)

Gas Safety Code.

American Gas Association.

Bureau of Standards.

The above are sponsors appointed by the American Engineering Standards Committee to develop the code. Report (A E S C No. K-2) has been submitted but not yet adopted.

Installation and Operation of Acetylene Equipment.

Regulations of the National Board of Fire Underwriters.

Recommended by the National Fire Protection Association. 1920.

Storage precautions, description of apparatus, and directions for operation. Use of acetylene gas in welding and cutting.

Installation, Maintenance and Use of Gasoline Vapor Gas Lighting Machines, Lamps and Systems.

(*Continued on p. 257*)

GAS AND GAS LIGHTING, ETC. (*Continued*)

Regulations of the National Board of Fire Underwriters.

Recommended by the National Fire Protection Association. 1919.

Descriptions of systems with rules for installation, safe operation, and maintenance.

GLASS

Specifications for Lime Flint Glass Tumblers.

Bureau of Standards, U. S. Dept. of Commerce (C-119).

Standard methods of sampling and testing for quality.

INKS

Inks—Their Composition, Manufacture, and Methods of Testing.

Bureau of Standards, U. S. Dept. of Commerce. (C-95).

Standard methods of laboratory analysis.

Composition, Properties and Testing of Printing Inks.

Bureau of Standards, U. S. Dept. of Commerce. (C-53).

Standard methods for quality testing.

INSTRUMENTS AND TESTING APPLIANCES

Testing of Thermometers. (C-8).

Testing of Glass Volumetric Apparatus. (C-9).

Testing of Hydrometers. (C-16). 1922.

Testing of Optical Instruments. (C-27).

Testing of Barometers. (C-46).

Specifications for and Measurement of Standard Sieves. (C-39).

Bureau of Standards, U. S. Dept. of Commerce has adopted the above.

Specifications, manipulation, and test methods in use for standardization.

LAUNDRIES

Safety Code for Laundries.

Associated Government Labor Officials.

Laundry Owners National Association.

National Association of Mutual Casualty Cos.

The American Engineering Standards Committee has appointed the above as sponsors for the code, which is in course of preparation. (A E S C No. X-8).

LUBRICANTS

(These are all listed under Petroleum Products and Lubricating Oils.)

LUMBER

Logging and Sawmill Machinery Safety Code.

Bureau of Standards, U. S. Dept. of Commerce. (In Process.)

Submitted to the American Engineering Standards Committee. (B-13.)

Felling trees, sawing, conveying logs. Conveying and routing lumber in sawmills.

Grading of Yard Lumber. (Recommended Standard Specifications.)

Forest Products Laboratory, U. S. Dept. of Agriculture. 1923.

Nomenclature, marking, standard specifications for grading, shipping instructions.

Grading Rules and Working Stresses for Structural Timbers. Recommended.

Forest Products Laboratory, U. S. Dept. of Agriculture. 1923.

Commercial grading methods and scale definitions, strength factors, care of timbers.

Manufacture and Grading of Northern White Cedar products.

Northern White Cedar Association. Rev. Jan. 1923.

Standard specifications covering limit of defects, methods of measurement, methods of manufacture, etc., for posts, shingles, ties.

Bridge and Trestle Timbers for Railroad Structures.

Southern Pine Association. Jan. 1917.

Classification and methods of inspection.

Classification, Grading and Dressing Rules for Southern White Pine Car Material.

Southern Pine Association. July 1919.

Also recommended practice of Master Car Builders' Association, American Railway Association and Master Mechanics' Association.

Definitions and limits of defects. Material for sills and framing.

Woodworking Machinery Safety Code.

International Association of Industrial Accident Boards and Commissions.

National Bureau of Casualty and Surety Underwriters.

The above are sponsors appointed by the American Engineering Standards Committee and have submitted report. (B-12).

Wood—Methods of Test.

American Society for Testing Materials.

Forest Service Laboratory, U. S. Dept. of Agriculture.

The above are sponsors appointed by the American Engineering Standards Committee. Report not yet submitted. (A-16).

Testing Small Clear Specimens of Timber. Tentative Methods.

American Society for Testing Materials. (D 143-22 T). 1922.

LUMBER PRESERVATIVES

Standard Methods of Sampling and Analysis of Creosote Oil.

American Society for Testing Materials. (D 38-18). 1918.

MACHINERY AND MACHINE PARTS

Safe Practices for Grinding Wheels. Recommended Procedure.

National Safety Council.

Inspection, storage, mounting, speeds, work rests, guards, dust removal, etc.

Safety Code for the Use and Care of Abrasive Wheels.

(*Continued on p. 259*)

MACHINERY AND MACHINE PARTS (*Continued*)

American Society of Mechanical Engineers. Dec. 1915.

Revision of code of National Machine Tool Builders' Assoc. and Abrasive Wheel Manufacturers.

Revised in 1922 by the International Association of Industrial Accident Boards and Commissions, and the Grinding Wheel Manufacturers of the United States and Canada.

Approved as a Tentative Standard by the American Engineering Standards Committee. (B 7-1922). 1922.

Safety devices, protective flanges, guards, general requirements.

Uniform Cost System for Grinding Wheel Manufacturers.

Devised by the manufacturers' association. 1918. Elements of the cost system. Methods of handling department expenses, etc.

Power Press and Foot and Hand Press Safety Code. National Safety Council.

Approved as a tentative standard by the American Engineering Standards Committee (B 11-1922). 1922.

Requirements for presses doing blanking, trimming, drawing, punching, or stamping.

Inspection Standardization for Gears.

American Gear Manufacturers' Association. Apr. 1921.

Under revision by this Association and the American Society of Mechanical Engineers under the procedure of the American Engineering Standards Committee. Report submitted. (B-6).

Methods of inspection of spur and bevel gears, helical gears, etc.

Machine Tools Safety Code.

National Machine Tool Builders' Association.

National Bureau of Casualty and Surety Underwriters.

The above are sponsors appointed by the American Engineering Standards Committee, and have submitted report. (B-14).

Sheet and Plate Metal Working Safety Code.

Proposed for consideration to develop a standard under the procedure of the American Engineering Standards Committee.

MATERIALS—MISCELLANEOUS

Testing of Materials.

Bureau of Standards, U. S. Dept. of Commerce. (C-45).

Standard methods of tests for various important materials.

METALS—FERROUS

Standard Methods of Test for Magnetic Properties of Iron and Steel. (A 34-18). 1918.

Standard Methods of Chemical Analysis of Plain Carbon Steel. (A 33-14). 1914.

Standard Methods of Analysis of Alloy Steels. (A 55-15). 1915.

Recommended Practice for Annealing of Miscellaneous Rolled and Forged Carbon Steel Objects. (A 35-21). 1921.

Recommended Practice for Annealing of Carbon Steel Castings. (A 36-14). 1914.

Recommended Practice for Heat Treatment of Case Hardened Carbon-Steel Objects. (A 37-14). 1914.

Standard Definitions of Terms Relating to Wrought Iron Specifications. (A 81-21). 1921.

Standard Methods of Sampling and Chemical Analysis of Pig and Cast Iron. (A 64-16). 1916.

Tentative Methods of Chemical Analysis of Plain Carbon Steel. [To replace (A 33-14).] (A 33-22 T). 1922.

Tentative Methods of Chemical Analysis of Alloy Steel. (A 55-22 T). 1922. [To replace (A 55-15).]

Recommended Practice for Heat Treatment of Carbon-Steel Castings. [To replace (A 36-14).] (A 36-22 T). 1922.

Tentative Methods of Metallographic Testing of Iron and Steel. (E 3-21 T). 1921.

The American Society for Testing Materials has adopted all of the above.

Iron Tests. (Recommended Practice).

American Railway Association.

Methods of testing the following:

Wrought-iron bars, refined. Standard adopted 1914.

Iron, engine bolts. Standard adopted 1916.

Iron, foundry pig. Standard adopted 1906. Rev. 1916.

Numbering of Steels.

American Society for Testing Materials.

Society of Automotive Engineers.

The above have been appointed as sponsors by the American Engineering Standards Committee to develop a code. Report not yet submitted. (G-15).

METALS—NON-FERROUS

Standard Methods of Battery Assay of Copper. (B 34-20). 1920.

Tentative American Standard. (K 12-1921). 1921.

Standard Methods of Chemical Analysis of Pig Lead. (B 35-20). 1920.

Standard Methods of Chemical Analysis of Spelter. (B 38-21). 1921.

Standard Methods of Chemical Analysis of Alloys of Lead, Tin, Antimony, and Copper. (B 18-21). 1921.

Tentative American Standard. (K-5-1922). 1922.

The American Society for Testing Materials has adopted all of the above. Notation regarding Tentative American Standard shows adoption by the American Engineering Standards Committee.

(*To be continued in a subsequent issue.*)

MANAGEMENT AND ADMINISTRATION
FOR OFFICERS EXECUTIVES AND DIRECTORS OF INDUSTRY
MEN MATERIALS MACHINES

VOLUME VI SEPTEMBER 1923 NUMBER 3

Some Fundamentals of Management

By ALVAN T. SIMONDS
President, Simonds Saw and Steel Company

IN the last analysis the chief responsibility for the success or failure of a business rests with its manager. If his business is not forging ahead, the manager must find and correct his mistakes—that is, he must become more efficient. If he cannot or will not do this his business will fail.

According to a great business leader no engineer employed to put a declining business on its feet ever succeeded in doing this unless he first succeeded in changing the management. He was employed by poor management to overcome the results of its incompetence. The only way in which he can overcome the results of this incompetence is to get rid of it and install competence in its place.

As management is of such importance and Bradstreets' says the great majority of failures in the United States are directly due to incompetence, the manager of any business should be on the alert continually, watching both his competitor's business and his own, planning, guiding, checking results, and carrying this checking process right back to himself, to discover whether he is approximating his maximum efficiency. Nor should he postpone this checking of his own efficiency until a failing business brings its necessity to his attention. It may then be too late. This process should anticipate and prevent any falling off in business that can be prevented by good management.

Among the many requirements that go to make up good management there are some that are so obvious and of such everyday character that they are liable to be taken for granted and overlooked. And yet they are just as essential to successful management as are the larger and more striking requirements. Some of these form the subject matter of the present article.

The Good Manager Must Be Open-Minded, Fair and Progressive

As business men grow older they ordinarily tend to become less open-minded and less fair in their decisions. This is only natural. If the manager suspects this is his own condition he should check his decisions with those of younger men who are well informed, progressive, and in whom he has confidence.

Before making a decision all the essential facts in the case must be considered—it must be examined from all sides. This examination must be adequate, but not go too far. The manager must be able to discriminate between essential facts and those which are not essential. This is where Hamlet failed so signally. He could not discriminate between the essential and the non-essential. He saw so many sides of the case, so many facts that he thought essential, that he could not act—he was unable to reach a decision. The failing is a common one.

The good manager must be fair in his decisions.

Frequently, however, decisions are forced upon him by the importance of some one factor, and these decisions may seem unfair to others not so well informed. If, however, his decision has been a fair one, he must disregard or meet as best he can the criticisms of others. It is a part of good management to do this with the least friction and in such a way as to secure the most cheerful co-operation.

The good manager must naturally be progressive or his business will either dry up or remain in a position of non-growth. When a person's mind becomes fixed and so completely organized that real progress is not possible, he joins the class of "old fogies." A great psychologist has said that most persons become old fogies at about the age of 23. Such a one cannot be open-minded and fair. He may listen to your arguments, but they do not mean anything to him.

The only way in which old fogyism, or a static condition of mind, can be avoided is by constant study and investigation. Boys in their teens today know more about radio than their science teachers, who have slowed up and have not kept going. No one can keep up with the times simply as a result of his own experience, because no experience can be broad enough to cover every field. Experience alone can, of course, keep one abreast of the times, and perhaps ahead of the times, in some one particular limited field. Edison, for instance, on many phases of electricity, cannot gain knowledge from books because along these lines he is in advance of written knowledge. On other phases of electricity he may be far behind.

In the same way a business leader may be working in some special very limited field, and have no need of study or reading outside of his immediate individual responsibilities. It must be a very peculiar field, however, if others are not also working in it, and he can and should learn as much as he can from others or he will soon fall behind. He keeps up with the times if he gets new knowledge as fast as others do. He keeps ahead of the times if he gets it faster. It is the duty of business leaders to keep ahead of the times in their particular field. They need have no fear of competition as long as they do this.

The Good Manager Must Be Able to Select Efficient Subordinates

As already intimated the success of any venture depends chiefly upon the character and ability of the men directing it. When business enterprises are small they are usually one-man enterprises, and their failure or success depends upon the one man at the head. As they grow, perhaps to undreamed-of size, they are often still one-man enterprises, and their success or failure is then determined largely by the ability of that one man to select efficient subordinates.

Andrew Carnegie had a keen appreciation of this fact. His epitaph written by himself is as follows:

> Here lies a man
> Who knew how to enlist
> In his service
> Better men than himself.

Any man who can do this and then give these "better men" sufficient authority to make their ability really effective is a good manager.

While the selection of efficient subordinates is one of the most important qualifications of a good manager, a man able to select efficient subordinates will usually be equally efficient in other lines. Carnegie himself came up from the ranks and could do practically everything he required his subordinates to do. If, however, he had not possessed the ability to select efficient subordinates he would never have become a really wealthy man.

A Good Manager Must Be Able to Delegate Authority

No matter how efficient a manager's assistants may be they cannot be fully effective unless he gives them enough real authority to translate their thoughts and plans into action. He has selected these assistants for their ability and for the purpose of relieving him of direct responsibility, and they are unable to do this without an adequate delegation of authority.

The employment of assistants means that the manager reduces the number of people with whom he deals directly. If the enterprise is a large one it is evident its head is in reality manager of many correlated enterprises each one with its own head and assistants, and these sub-managers must have sufficient authority. Certain responsibilities must be shifted to their shoulders if they are to produce adequate results. The larger the enterprise the greater the responsibility entrusted to them.

The least difficult job in an industrial organization is to perform a definite, machinelike piece of work, involving little or no responsibility. It is said that 90 per cent of industrial workers want only this kind of job. The next job in order of difficulty is to direct a group of these workers with some responsibility for the quality and quantity of the work performed. The job next above is to superintend and direct some certain number of these foremen with responsibility for the effective performance of their duties. The scale of difficulty moves upward as the amount and character of the responsibility increases. To direct 10 foremen, each at the head of a gang of 10 men is a somewhat difficult and responsible position. To direct 10 superintendents each at the head of 100 foremen, when each of these foremen have 100 men under him, is a much more difficult and responsible position. As the scale rises men of the right kind—right by disposition, experience, training, and ability—become harder to find. On the other hand, when found, they are of the greater value and the authority and responsibility given them should correspond.

To delegate authority in the true sense is harder and harder as authority increases in importance. The men who are able to do this rightly in the larger fields are the geniuses of business. Their positions were gained through their ability rightly to delegate authority—at first in the smaller fields from which they were able to move on to the larger. The business manager who knows every detail of his business himself and himself decides each, is not getting the training for a larger position, and of necessity is neglecting the larger phases of his own business, even though this business may be a modest one. Such managers are altogether too common.

The Manager Should Provide Understudies

The accretions of an established business include more than the earnings in dollars. There is the trained human ability and power that come as a result of business experience. Such assets—frequently of the greatest value—may in a particular case be taken out of the business by the death or loss of one man.

There are still business leaders who hesitate to impart to others what they have gained from their experience. They are willing to use it for the benefit of the business while they are in the business, but if they leave or die it goes with them, and the business suffers. Some of the biggest leaders in industry are the worst offenders in this respect. Many businesses now plan their organization and systems of promotion so as to provide understudies for every important position.

Quick Decisions Essential to Good Management

The principal work of many, perhaps most, business leaders is, after proper consideration, to make decisions and initiate the steps for carrying them into effect. Men of action are those who quickly consider all sides of a question, come to a conclusion, and act upon it. They are "live wires"—men full of "pep" and "ginger." They get things done while others are only thinking about them and talking about them.

If a certain man can make 10 decisions and set going the necessary forces for carrying them into effect in the same time that another man consumes for making one decision, that is no better and worth no more to the business than one of the 10 made by the first man—if this is the ordinary rate at which the two work, then the first man must be worth to the business approximately 10 times as much as the second. In the last analysis men sell their ability and their time. What they are worth depends upon the quality and the quantity of what they can do in a given length of time.

Of course, the man who makes more decisions may make poorer ones and for this reason his work may in the end be worth less than that of the man who makes fewer decisions. Like work on production in a factory, his decisions must not come on so fast that they are defective nor so slow as to hold up the work of others.

The Manager Should Be a Scientific Optimist

One of the weakest, if not the very weakest, reply of a business manager to a suggestion is: "It can't be done!" It does not make it any stronger to add: "It has been tried and failed."

Positively, conclusively, mathematically, it was demonstrated that machines heavier than air could not fly. Also it was pro[illegible] structed light enough, [illegible] real enough to make the [illegible] possible. Almost everything [illegible] man has done has been clearly [illegible] impossible, before he did it.

Business leaders are human beings [illegible] like ordinary human beings. So they [illegible] little too much inclined to believe, "I[illegible]" Occasionally realizing this human [illegible] lean too far in the other direction as [illegible] Ford does. It is said he allows no re[illegible] of trials which fail, for such records ma[illegible] trials which might prove successful. T[illegible] possible means only that it has not [illegible] morrow it may be the possible, because some[illegible] done it.

This attitude on the part of a business [illegible] does not mean that he is immune from mistakes. Neither does it mean that nothing is impossible to men. Every business policy must be used, not abused. Science has definitely established certain truths. Even business science and economics have demonstrated some propositions. Perhaps a man as able as Henry Ford would be unwise enough, if he had the power, to put his visionary money scheme into actual use throughout the entire United States.

On the other hand business management seems very often to develop overcaution, overconservatism, and too great satisfaction with things as they are. Business men are prone to become too sure, and to "know" without careful investigation that new facts, discoveries, and inventions are foredoomed to failure. The good manager is always willing to take a reasonable chance if the rewards of success are sufficient.

The Good Manager Must Be a Good Loser

This does not mean that he must not care if his business fails and becomes bankrupt. Any man who engages in business takes a risk at some time and in some direction. He may lose and if he does he must accept his loss with good grace. He must even look forward to its possibilities—or in some cases, to its probability.

Most business ventures meet with years that show losses, sometimes very large. The future looks dark and uncertain. Then is when the business man must prove himself a good loser. He must have the vision and the courage to press on into the year ahead with not only the hope but the expectation that his previous losses will be more than offset by his coming gains.

The business directors, who during the depression of 1921 courageously wrote down their inventories and put their houses in order, and intelligently made ready for the revival of business, were repaid by profits they otherwise would not have gained. And the revival came so much sooner and more rapidly than was expected by many, that the profits of those who had been good losers and had not lost their courage were correspondingly large. Those who were not good losers really made losses by not being ready to make profits—they were not good managers.

Competition or Co-operation in Business

By E. H. FISH

WHY should I spend thousands of dollars making improvements in my methods of manufacture that will merely save me 2 or 3 per cent of my costs, when if I could only get my competitors to see it, we could all raise our selling prices 100 per cent and put most of it on the profit side of the ledger?" This is, baldly speaking, the answer which is more and more often given to the approaches of cost specialists. It is usually camouflaged under some other heading, such as "co-operation instead of cut-throat competition," but in the end it means the same thing: "Why save at the spigot when I can get two barrels instead of one?"

The New Cry in Business

The old problem was how to keep on operating when competitors were making price concessions to secure business. The new cry is: "Get while the getting is good." If I manufacture candy, I can make myself out to be a public benefactor if by raising the price I save half of it going into the stomachs of our young people. Incidentally I expect to get a sufficient share of the business so that my net profits are approximately doubled.

Whether we admit it or not, whether we recognize it or not, we are rapidly drifting from competition to co-operation. The word drifting is used intentionally. There is no concerted plan except for a few who are far-sighted enough to steer their own ways as much as they can in the current in which we are all being carried along. Formerly when a man was discovered to be making a comfortable living in a town by shoeing horses, someone else through jealousy, or spite, or his own selfishness, immediately started competition. For several years the town had cheap horseshoeing and two blacksmiths that had no spare change for the contribution box. If the town grew rapidly there was a chance that for a year or two they might both make a good living until the third man came in to set up opposition. Now when a garage appears to be making a good thing in this same town, someone else comes in, but instead of entering into competition, the two men get together and agree to raise prices for repair work to such a level that there will be a living for both.

Spying Out the Land

In the former case only the two blacksmiths and their families suffered directly. In the latter case each person who has a machine suffers a little, and that includes almost everybody. The old way was, however, provocative of ingenuity and hard and efficient work; the new way is not. Carried to an extreme the new way is at least as bad as the old. In moderation, the new way is the better. The firm that goes at its business ventures logically will send a man to the town that looks like a good stand for a garage. He will count the autos that go past a given corner. He will count the people and observe whether there is a filling station or a repair shop a short distance away in either direction on the principal traffic lines. He will discover whether or not the local garages are getting all the business that their location justified, or if some is going by because the local people cannot handle it promptly. When he does settle on a site and the garage is built, he gets business not by cutting prices but by offering service. This costs him little because it simply means engaging employees who are awake and alive, and who make no greater demand on his pocketbook than the usual run of country garage men.

Class Number
658.821 Co-operation in Business

The same thing applies equally well to manufacturing establishments except that the scope of their sales force is wider. They go out into the market perhaps of the whole world, maintaining a price that will afford a profit to the most poorly run shop with which they would have competed under the old régimes, but competing with each other for business on the basis of quick, careful, and thorough service. Except for the abuses which accompany every new plan this seems like a real forward step. The smallest manufacturer of machinery, or textiles, or chemicals, can within his capacity give as good service as the biggest plant, except in point of quantity delivery. His quality can be maintained, his delivery dates can be set so they can be kept just as well as if his shop were a mile long.

The great danger is in the abuses and the consequent government interference with business. There are always those who cannot restrain themselves from running up prices as far as today's traffic will allow without a thought as to the effect on tomorrow's business. The public stands for about so much extortion and then it yells for restrictions, and government restrictions are always accompanied by demands for data that cost all out of proportion to the benefits gained. Whether restrictions on price advances can be controlled effectively by a trade organization under existing laws is an open question, but if they can be maintained at a reasonable rate the advantage will be great. Otherwise the buyers, who constitute a "bloc" of constantly increasing size and power in this country, will appeal to the lawmakers. The latter, having due respect for the growing bloc, will oblige by enacting laws looking toward price control.

Even then, within the range of these better prices for goods there is just as much scope for the competent engineers or cost accountants to effect savings as ever. The fact that a manufacturer assures himself a profit through co-operation by no means lessens his desire for further profits which may be had by cutting costs of manufacture. Most men can, however, see the profits from co-operation much more clearly than they can any other type just now.

Increased Profits Through Control of Costs

I—Production Routing

By R. W. DARNELL

Class Number
657.524:658 Cost Control.
658.512 Routing. Management.

THE cost department in most institutions is looked upon as a dead expense, and its sole reason for existing is the fact that in order to know profits monthly it is first necessary to know costs. That is about the only purpose the department has served outside of an occasional feeble attempt to control cost, and it has been found, generally, that a department of this kind is a troublesome and expensive proposition.

It is for this reason that so many cost systems are discontinued or curtailed during times of depression almost before any other reduction is made in expense. This is to a great extent the fault of the cost accountant inasmuch as he does not make the cost system of the utmost usefulness to the management. His cost system should be and will be as indispensable as any other department in the organization if he will make it a profit producing division rather than "a dead expense." The way to make a cost system a profit producer—and the only way—is to use it as a means of reducing cost, and this must be done by first securing control of cost and then by forcing this cost down to the lowest practicable point and keeping it there.

Management is more and more coming to realize that the cost control feature of cost accounting is by far its most important function. Not satisfied with the mere knowledge that a certain manufactured part or product costs so much, the present-day manager wants to know why it costs that particular figure, whether or not it could have been produced at a lower cost, and if not, why not.

Cost cannot be successfully controlled by the ordinary cost system. This is due to the fact that its information is in most cases so old when it does come that it cannot be used to advantage in controlling costs. Beyond this there is usually no standard of measurement with which to compare costs when found. Obviously they cannot be said to be high or low without a standard by which they may be measured.

To correct all this a radical change must be made in the usual methods of cost accounting. This fact is being recognized by the more progressive cost accountants who are rapidly changing to standard cost methods. These methods, while doing everything the ordinary cost system does in the way of statistics, also give that control of costs which is so essential to economical manufacturing.

The standard cost idea is not new but its methods are not in very wide use as yet, possibly because they are but little known and are looked upon as complicated. As a matter of fact standard cost is the most simple and common-sense method of cost accounting that has yet been developed and it is only a question of a short time until it will be used generally.

It has been said that the use of standard costs is limited to those industries whose product is standard and whose operations are of a repetitive nature. It is true that the system functions better under these conditions of manufacture, as does any other cost system, but at the same time standard costs with suitable modifications are applicable to almost any line of industry. However, as the plant manufacturing articles on a repetitive basis is the type most common in industry, it will be used for purposes of illustration in the present discussion.

Before entering into a detailed consideration of standard cost, it might be well to ask the question: "What is a cost standard?" This can be answered by saying that a cost standard is a production standard and it may be described as the most efficient method of producing a given article under given circumstances.

The next question which might be asked is: "What is a standard cost?" This may be said to be that cost which would result from the most efficient method of producing a given article under given circumstances. It is not an impossible cost or a goal set up merely to shoot at, but is a cost which may be attained if a reasonable amount of efficiency is used.

Naturally a standard cost system to be a success must be based on data which is reliable. It is impossible to operate a standard cost system unless the proper foundation has been laid in the factory itself, not only to establish the standard but to furnish the data necessary to check actual performance against the standard.

Organizing the Cost Department

The cost system in most institutions has for years been looked upon as something apart from the other systems in the plant, and in many cases those in charge of factory systems had very little knowledge of what was actually done in the cost department. As a matter of fact there has always been a great deal of strife between the cost department and the production manager or superintendent. This is all due to a lack of understanding between the two divisions and can be easily overcome by linking up the cost system with the factory systems of routing, planning, and wage incentive plans in such a way as to make the whole one continuous system. The factory superintendent or the production manager then can no longer say that the costs are not right without admitting that the system in the factory is wrong, because the costs are compiled from the data supplied by the factory divisions.

A cost system is as strong as its foundation, and the foundation of a cost system is in the factory. It is the strength—the excellence—of the planning, routing, and wage incentive system that will make or break the cost system. Every industry that expects to stay in business and make a success must have an adequate planning system. That same industry must also have the best wage incentive plan obtainable if it expects to produce efficiently and therefore economically. With these two systems must go a perfect system of production routing. These things are of absolute necessity to manufacture successfully, and, as said before, constitute the foundation of the cost system.

In systematizing a factory the cost system should be the last thing undertaken, for to do otherwise would be to put the cart before the horse. Many systematizers, in their effort to show results quickly, make the mistake of establishing the cost system first, and as a consequence the management is disgusted by the expenditure of large sums of money with nothing to show for it, and the system is discontinued. The proper sequence for installing a complete system would be to establish, first, production routings, second, time-study and incentive system, third, planning system, and fourth and last, the cost system. Building a system is exactly the same as building a machine, and the parts must be made and assembled before the machine can be operated.

Production Routing

The first consideration in establishing an effective system of standard costs is the routing of production.

In manufacturing any fairly complicated article a great many processes and operations are necessary before it reaches completion. All the parts entering such an article must be fashioned or machined to certain dimensions, on certain types of machines, and with certain tools and fixtures. Some one person or perhaps a number of persons in the organization know all these necessary steps—what tools are to be used, what dimensions the various parts are to be machined to, etc.; but usually this essential information is carried in the heads of a few foremen or other "old timers" about the shop, and is not available to all who wish to use it. The purpose of the production routing is to take the information which the foremen have been accumulating for years and record it in black and white for the use of any who require it. In this way the institution is protected from serious loss should anything happen to one of its "pivot" men.

Production routings may be written in a number of ways, but the loose-leaf binder method is perhaps preferable for the reason that the sheets are easily accessible, and cannot be misplaced or lost once they are placed in the binder and the binder locked. It is necessary to have a sheet for each part and assembly. This sheet will bear the part number and name of the article, as well as a description of the material which is required for its manufacture. Fig. 1, "Production Routing" shows the form of the routing sheet and the important nature of the production routing information. It will also be helpful in following the present discussion.

Cutting Costs by Better Production Routing

The actual work of building up the routing should be done by a man who is a thorough mechanic and who has had a great deal of experience in production work, for in most plants it is in the analysis of the processes of manufacturing that a great deal of money can be saved. With a close check of all tools and set-ups it is very often possible to make changes in process that greatly facilitate production. Care should be taken, however, to see that the cost of changing the process is not more than that which will be saved. For instance, it very often happens in plants where production is limited, that more efficient machining can be done with differently designed tools, but the quantity produced is not sufficient to offset the cost of this better tooling.

There are probably more inefficiencies existing in assembling departments than in any other division of production work, and a close check up of process is therefore very important. An illustration in point is the assembling of dental chairs, a product which is far more complicated than would at first sight be supposed. These chairs are composed of about 400 different part numbers and until a few years ago were put together under the unit assembly method, that is, the complete chair was assembled by one man. This required a worker with long experience and necessitated a great deal of room for his work, for storage of parts, handling, etc. The idea behind this method was that one man could be held responsible for all the work of assembling on a particular chair, thereby guaranteeing a higher standard of quality. The plan was very fine in theory but in practice it proved to be both inefficient and expensive. This was due to the fact that each assembler had to handle so many parts and so many tools that he could not possibly reach the degree of efficiency that is gained in less diversified work. Not only did it cost far more to assemble under this method, but it took several months to break in a man to do the work from start to finish, and once he reached the stage of a finished assembler he had his employer at a great disadvantage as regards wages and conduct. He knew that a great deal of time and money had been spent in training him and that his employer could not afford to lose him.

In order to overcome these conditions, the assembling of the dental chair was completely changed by the adoption of a method known as progressive assembly. In preparation for this change the work was analyzed from beginning to end according to its various elements. The result was that the work which was formerly done by one man, was divided into about 10 assembly operations of equal length, and one man was assigned to each of these operations. The men engaged in this work, lined up along a bench progressively, or in the order in which the various operations on the chair were to be performed. Each man was given only those parts which he was to assemble together with what few tools were necessary.

The first operation was started at the door leading out of the finished parts stockroom and the last operation completed at the door entering the shipping-room. This meant that there was no back tracking with the product as everything moved along from one operation to the other with no confusion until the chair was completely assembled. In an operation as long as this there is sure to be some difference in the time consumed by each assembler, so to prevent any waiting for work slack was taken up in the line by having a cushion of one chair between each operation.

This change in assembly method had many advantages, chief among them a reduction in labor cost of some 30 per cent. This saving was later increased to about 50 per cent when the work was time studied and placed on an incentive basis. [illegible] quality of the work did not suffer [illegible] arrangement as a [illegible] under the old method. It also made [illegible] break in new men on the work, and [illegible] old men such a hold on the employer [illegible]

RITTER DENTAL MANUFACTURING COMPANY, INC.

[illegible]

[illegible] Date Revised [illegible] [illegible]

PART NAME [illegible]

Dept. No.	Oper. No.	Operation Name	Machine	Tools, Jigs, Fixtures	Speed	Feed	[illegible]	[illegible] Make [illegible]
1	5	Finish turn 0.743 in. plus or minus 0.002 in. diameter, 2.947 in. long and cut off [illegible] in. plus or minus 0.004 in. long	1¼ in. Cleveland Shaft No. 420	Spindle [illegible] Comb. box and forming tool [illegible] Gears 33, 67, Cams B-7, D-92 1 8 x ¼ in. cut off tool	675		[illegible]	[illegible]
3	8	Center, drill ½ in. [illegible] in. long. Face to length. Form radius inside of holes and outside diameter	No. 4 Warner & Swasey Hand Screw Mach. 3-D	Flat center bit ½ in. drill high speed 1¼ in. Hollow Mill Comb. radius tool inside and out	[illegible]	[illegible]	[illegible]	[illegible]
3	12	Center, drill ½ in. [illegible] in. deep. Chamfer. Thread [illegible] 20, thread [illegible] in. long	No. 4 Warner & Swasey Hand Screw Mach. 3-D	Flat tool bit ½ in. high speed drill Chamfer mill ¾ in.—20 thread die [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	15	Mill slot 5/16 in. wide, 2 15/16 in. deep at bottom in small end with 3 in. cutter leaving 3 in. radius tangent to 1 end 1/8 in. below center line of ½ in. hole through center of piece.	No. 2 Cinn. Horiz. Mill No. 708	Special vise jaws 5/16 x 1 in. diameter side cutter.	735	0.053"	[illegible]	[illegible]
9	20	Drill (2) ¼ in. diameter holes through one wall. *Note* Be sure slot is up in fixture when drilling.	Natco Type No. 11 Mult. Drill Press No. 927	(2) ¼ in. diameter drills Special shank for Natco spindles	900	[illegible]	1.00	[illegible]
8	26	Grind O.S diameter to 1.1245 in. plus 0.0000 in. minus 0.0005 in. ring gage.	Centerless Grinder No. 825	Wheel 1.1245 in. ring gage [illegible]				
5	30	Burr all sharp edges of milled slot and shoulder inside and out. Turn end for end and burr (2) drilled holes and sharp edge of diameter	Bench work	File and scraper 1 rat-tail file			1.80	[illegible]
13		White Nickel—Account No. 207	Electro Plating Tanks					
21		Inspection.						

FIG. 1 ROUTING SHEET

This illustration [illegible] what can be done with [illegible] ing of production and [illegible] portant it is that a system of [illegible] tion routing be maintained.

In order to carry out [illegible] routing successfully all operations should be numbered. In doing this it has always been the custom to number operations 1, 2, 3, 4, 5, etc., but this involves considerable loss and confusion when numbers are changed as they frequently are. For instance, it means that when operation 2, for example, is "obsoleted," all the operations which follow must be renumbered if the system is to be maintained. Thus the operation which before was 3 is now 2, and that which was 4 is now 3, etc. If there are many such changes of the operation number, the operation loses its identity; and it will be necessary to make the operation cost comparisons by description only. This is inaccurate, and therefore very unsatisfactory. Changes of the operation number also cause a great deal of work re-writing the routings, and allow more chances for error.

As a great many foremen and workmen memorize their operation numbers for the purpose of drawing tools from the tool crib and as reference among themselves, the possibilities of error in the serial number system are readily seen. For instance, if the operation numbers are constantly changed, it becomes necessary for the men employed on the work to refer to a routing book to find their operation numbers. Foremen in general, and workmen in particular, do not, however, appreciate accuracy in operating a system and they are prone to take a chance on the operation number; especially when they are not aware that these numbers have been changed. As a whole, the 1-2-3 method is extremely unsatisfactory.

As a substitute for this method it has been found better to number in intervals of fives—5, 10, 15, 20, 25, etc.—a plan which has none of the objections of the 1-2-3 system. For instance, in case of operation 5 being obsoleted, it is simply left out of the new routing, all other operations remaining the same as before. Nor will 5 ever be used again unless at some future date the operation is reinstated, in which case it will again appear on the routing as 5. On the other hand, if it is found desirable to divide operation 5 into two operations, the numbers on any of the other operations are not changed; the first section of the split operation would be numbered 3; the second 7; and 5 would be obsoleted. By reference to the routing book the transaction is immediately recognized by the numbers 3 and 7. If operation 5 has had more work added to it, it is obsoleted as number 5, and the new operation bears the number 4.

The advantages of the 5-10-15 method of numbering over the 1-2-3 method are obvious.

The Routing Sheet

In order to permit easy tabulation, and because of the other advantages secured thereby, all departments in the plant are numbered. For instance, the toolroom might be No. 1; Punch Press, No. 2; Hand Screw Machine, No. 3, etc.; and this information is tabulated in the first column of the routing sheet (Fig. 1). The operation number should appear in the second column.

A complete description of the work to be performed under each operation number is also necessary; and this information is set down in the third column. In the next is listed the machine number or machine group upon which it is most desirable and economical to machine the part. In the next, the tools required to produce the operation are described, so that by drawing from stock the specified tools, it is known the right set-up will be obtained. There are also other advantages in having the tools listed, which will be discussed in a later article. The other columns on the routing sheet will also be explained in the same article.

In making up the routing, the greatest care must be exercised to get it accurate in every detail, as this is the foundation of all factory systematizing. If it is wrong, errors may occur that will cost the company hundreds of dollars.

There are several departments in the organization which will require complete sets of routings. These are probably the production and planning department, mechanical engineering, cost, pay-roll, tool designing, production control stations, and, perhaps, one or two other departments.

The manufacturing departments such as the lathe, milling, drill press, etc., will each have a routing book. Inasmuch as all parts do not go through these departments for machining, their books need not have complete sets of routings, but only routings for those parts on which they actually do work. This saves stationery and clerical work, and also keeps the records themselves from becoming cumbersome.

The factory timekeepers, whose duty it is to keep the time of operators will also require routings for the departments under their charge. If one, for instance, takes care of departments 5, 6, and 7, he must have the routings for the parts which go through these departments for machining.

Maintenance of Routings

In maintaining routings, some specific department must be entrusted with the work. It would never do to allow changes to be made promiscuously; for if this should happen, the routings would soon be of no value. Since the planning department has made up the original routings, it is probably in the best position to maintain them. If so, under no circumstances should anyone outside be allowed to make changes on the routings. Anyone who cares to may request a change, but it is the duty of the planning department to determine whether the suggested change is necessary, and if it is, to see that it gets into the routing books.

This formality in making changes may seem unduly restrictive; but when it is considered that a great amount of money has been invested in this routing, it is not reasonable to expect the manufacturer to lose this asset on the whim of some foreman or superintendent, especially as they may, with a few minutes extra time make any really needed changes through the proper channels. It is highly important that some one with a thorough knowledge of machine methods should check all such requests for changes or additions to the routings. If this is not done, and operation changes are made simply because they are requested, it will be only a few months before the routings are almost hopelessly cluttered up with useless operations.

Avoidance of Temporary Changes

A routing should contain nothing but the standard method of performing a piece of work; and this, if all work is done correctly, according to the routing and blue-print, should be all that is required. No change should then be made in routings unless the change in process is necessary and permanent. To illustrate, suppose the operator of a hand screw machine allows his tools to become dull, so that it throws up a burr on the part. When the parts get to the assembling department it is found that they do not fit on account of the burr and they are sent back to the machine shop to be burred. The foreman in charge of the work will probably request the addition of a burring operation to the routing, so he can charge his time. This work should not be charged against the part itself, however, but to nonproductive labor against the department committing the error; for if the work had been performed correctly in the first place, it would not have to be burred now.

It is very often the case, when a temporary or unnecessary operation of this kind is placed on the routing, that it is never removed; and consequently, the work is continued on the part long after its necessity has ceased to exist. This is far from an economical condition. If, on the other hand, the charge is made to the department committing the error it is brought much more forcibly to the attention of the foreman of that department, and the error is far more likely to be corrected than if it was charged directly to the part itself, and became buried in the costs.

So, as has been stated before, all routing changes should be checked before they are made—if they are made. By this restriction of changes, incorrect manufacturing methods are brought to light and corrected much more readily than would otherwise be the case, and, generally, a more satisfactory and a more economical manufacturing condition will prevail throughout the plant.

More Output: Lower Costs: Control

Management Results in a Veneer Box Shop

By E. E. AMES

Vice President and Director of Sales, The General Box Company
Formerly, President, The Pioneer Box Company

Class Number
674.65:658 Veneer Box Manufacture. Management
658.9:674.65 Management. Box Manufacture

THE literature of management results is meager, and articles and papers describing what improved management methods have done in small plants are practically non-existent. This does not imply that improvements have not been made and betterments attained in shops employing only a small number of men, but rather that their records have been overshadowed by those made by large and medium-size plants.

However, the possibilities in the small shop making a simple product are quite as important qualitatively, and to a certain extent quantitatively, as in larger organizations. Again, it is sometimes thought that the real field of modern management is in connection with a product which is complex or highly organized. This belief is fallacious, for the control of a standardized quality which may not be precise, but yet is established within definite limits, is quite as important as that of a product which is made to very fine limits of size and finish.

Proof of the truth of these general statements in regard to management is given in the record of the installation of improved management methods and the results secured in the plant of what is now the Pioneer Division of the General Box Company, in East St. Louis, producing veneer shipping boxes. (See Figs. 1 and 2.) When the installation was made the plant was operating as one of two of The Pioneer Box Company, the other being at Crawfordsville, Illinois; but within a year, through the consolidation of some 14 plants, both have become manufacturing units of the larger company.

Before describing the management installation it is perhaps instructive to outline the general results which were secured. These can be presented under 6 general heads, although in another place in this article they are detailed as a dozen items. These 6 general advantages are:

1. The output of the plant was increased 25 per cent.
2. Quality of the output was improved, as shown by this fact: Before the management improvements were installed one repair man was required for each mat-making machine, now one repair man takes care of the output of three such machines.
3. The stock wastage is today 10 to 15 per cent less than before the management was improved, although the veneer and lumber now available are inferior in quality to that which prevailed five years ago.
4. Promises of delivery are now kept in 95 per cent of all cases.
5. The plant in all its details is smooth running because of complete control.
6. Methods of scheduling and routing orders means that today we have a view of the entire week's work where before it was hardly possible to plan a single day's work.

Fig. 1 Interior View of the East St. Louis Plant Pioneer Division, General Box Company

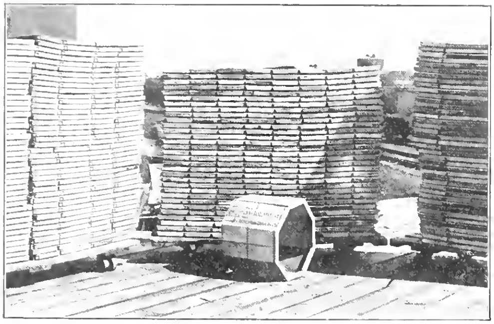


FIG. 2 TRUCK LOADS OF FINISHED MATS, AND A VENEER BOX

At the beginning of the year 1919 the conditions in the East St. Louis plant were these: Because of general business conditions and the close proximity of the plant to the great labor market at St. Louis, labor turnover was unusually high, and the caliber and capacity of the help unsatisfactory. This situation was in contrast to that which prevailed at the other plant, where the labor market was stable. Crawfordsville is a small town and the employees looked upon their employment as permanent, and expected that son would follow father in finding his work at box-making.

In general we have always taken active interest in developing and improving the management of these two plants, and had installed a unified cost system which was recommended by an association of box manufacturers. Various methods of providing incentives for the workmen in order to get their co-operation had been studied and several plans for bonus payment worked out. For instance, a plant bonus had been put into effect which was paid to all workers, including the office force. A premium bonus was paid for steady attendance to all workers who were in continuous attendance for an operating period of two weeks. A cull bonus was paid to the men repairing culls, or rejected boxes, and a box-machine bonus was paid to the crews of the box machines in proportion to the amount of product turned out. In short, we had lone seemingly everything that could be done to improve our management from the accounting standpoint.

FIG. 3 VENEER AND LUMBER STOREHOUSE

Then we sought more practical means to better the operation of our plant, and made investigations of what was being done by several management engineers and what results were being attained. We came to the conclusion, therefore, early in 1919 that the way in which we could make further gains was to apply engineering analysis and study to our particular problems.

One reason for accepting this point of view was that we found in surveying our plant that the various departments were not closely co-ordinated. For instance, if a series of orders for boxes came through requiring a great deal of cleat work, the department making the ends of the boxes and using cleats would get behind. On some occasions cars loaded with "mats" (the form in which the veneer boxes are shipped) stood on the siding for days waiting for the end department to catch up with its work, and get out the ends for these particular boxes. On the other hand, if plain ends were ordered the mat department was apt to cause delays.

As a result of this lack of co-ordination, demurrage charges were paid on cars and shipments were delayed.

FIG. 4 PLANNING AND CONTROL BOARD

A similar situation existed at times in connection with boxes which required printing. If an order came along requiring printing on both sides and ends, the printing department was apt to get out of step with the rest of the shop.

At this time we had no centralized planning methods, and the planning which was done was merely determining the sequence of orders by the foreman of the rip-saw department. Quite naturally he wished to run his own department in the easiest way regardless of the convenience or inconvenience of other departments. Under these conditions there was a natural tendency to run through the larger orders which required infrequent resetting of the machines, and to let the small orders wait. Naturally there were complaints from the customers who sent in small orders.

At length we decided to make use of engineering counsel in improving the management and operation of the plant. We engaged as engineers, The Thompson

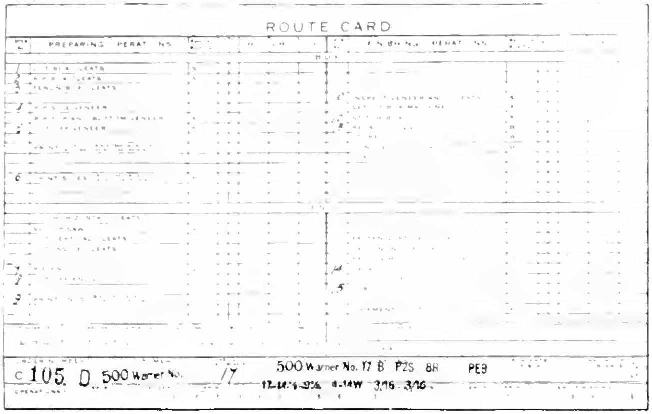


FIG. 5 A SPECIMEN ROUTE CARD

and Lichtner Company, which provided a resident engineer who began work in June 1919 under the direct supervision of a member of the firm. This service continued for six months. During the next six months only one-half of the primary service was required.

Our own organization, being trained from the very start, was able not only to carry the development step by step, but to make changes as everyone became more familiar with the routine which further simplified the procedure. During the second year the amount of consulting service was reduced to 23 days, and thereafter no consulting service was needed.

The work was begun at the East St. Louis plant. Here we were fortunate in having a superintendent of exceptional type. He became interested at the very start and took such a keen interest in the procedure that he even studied the detail methods and actually made time studies and job analyses. This personal experience placed him in a particularly fortunate position in that he was later able to check the standards developed by other members of his own organization. This attitude of active co-operation on the part of the superintendent was reflected throughout the entire organization, making it possible for the company to benefit to the fullest extent by the suggestions made in the course of the engineering and management work. As a result we were assured of an organization trained and experienced in the new methods and able to improve further the routine as conditions became favorable. One concrete result of these concentrated efforts of our organization was the reduction of the number of persons employed in the planning work from three to one.

An instance of how the amount of clerical work in the planning department was reduced is illustrated by the development of a symbol made up of letters and figures to give the necessary detail in regard to orders for boxes. Although this symbol is long and [illegible] the exact specifications [illegible] facturing for. These symbols [illegible] with rubber type [illegible] is used to stamp the [illegible] route sheets, material tickets [illegible]. A specimen symbol follows:

Quantity	*Length*	*Width*	*Depth*	[illegible]
500	30	x 19	x 10	B

[illegible]	*P[illegible]*	*O[illegible]*
W[illegible]	*Box S[illegible]*	*C[illegible]*
13 W	P2S	[illegible]

One of the advantages of the use of this symbol system is the reduction of the amount of detailed instructions required on each job ticket. Another advantage was the opportunity it gave the storekeeper to check the size of the material used against the size of the box, and thus prevent the use of wrongly selected material which will produce waste or leave an odd lot of veneer difficult to use up. Still another advantage was the notification to the Balance of Stores clerk whereby he is able to keep his records straight. Furthermore the individual operators on the machines are enabled to check errors in the detailed instructions for their particular operations.

Determining upon planning methods and setting up planning routine was not the simple matter which might be expected in a plant of this size and with our simple product. The difficulty lay in determining upon methods which would give real control and at the same time would allow one operation to start before the previous operation was completely finished. On a large order material might still be coming in from the veneer shed (see Fig. 3), while part of the same order was being loaded in the freight cars. This condition was not the rule, however, for many orders are received for comparatively few boxes, the smallest amount accepted being 25. However, inasmuch as this condition of manufacturing might exist, the necessity was faced to adopt a plan which would permit of starting the first operation and subsequent operations

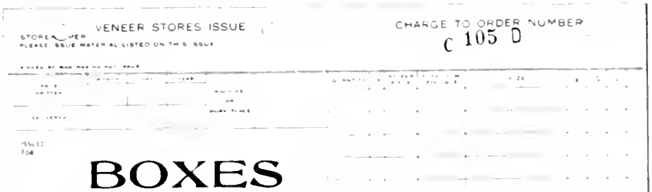


FIG. 6 STORES ISSUE TICKET

BOARD TICKET

C 105 D

RETURNED / ISSUED	
CUSTOMER	500 Warner No. 17 B P2S BR PEB
SPECIFICATIONS	17-14½-9¼ 4-14W 3/16 3/16
OPERATION	RIP B. C.

TIME TAKEN	TIME ALLOWED	RATE	BONUS	QUANTITY IN LOT	QUANTITY FINISHED

IF JOB IS NOT FINISHED CHECK HERE → IF JOB IS FINISHED CHECK HERE → MACHINE OR WORKPLACE

RETURNED ISSUED MOVE THIS MATERIAL

I have received the above material and find it correct (signed by Receiver) From ____ To ____

TIME TICKET

C 105 D

RETURNED / ISSUED	
CUSTOMER	500 Warner No. 17 B P2S BR PEB
SPECIFICATIONS	17-14½-9¼ 4-14W 3/16 3/16
OPERATION	RIP B. C.

TIME TAKEN	TIME ALLOWED	RATE	BONUS	QUANTITY IN LOT	QUANTITY FINISHED

IF JOB IS NOT FINISHED CHECK HERE → IF JOB IS FINISHED CHECK HERE → MACHINE OR WORKPLACE

LABOR $ COST . MACHINE $ COST . TOTAL $ COST . DATE QUANTITY TIME UNITS

GANG TICKET

ROUTE SHEET	TIME STUDY	PAY SHEET	COST SHEET	AMOUNT O. K.	AMOUNT REJECTED REPAIRABLE	AMOUNT REJECTED SCRAPPED	INITIALED BY FOREMAN

EMPLOYEE'S NO.		FRI.	SAT.	MON.	TUES.	WED.	THURS.	TIME	RATE	AMOUNT
	ON									
	OFF									
	ON									
	OFF									
	ON									
	OFF									
	ON									
	OFF									
	ON									
	OFF									
	ON									
	OFF									
	ON									
	OFF									
	ON									
	OFF									
	ON									
	OFF									

FIG. 7 BOARD TICKET AND TIME TICKET FOR RIP-SAW OPERATION

in progressive sections, allowing only sufficient time between operations to accumulate a reserve of material to permit of economical operation.

Difficult as this problem was, it was satisfactorily solved; and a view of one corner of the planning room, showing the planning board, is given in Fig. 4. The following illustration, Fig. 5, shows the card filled out for a particular order. Figs. 6 and 7 show in the first the stores issue ticket, and in the second a time ticket for the rip-sawing operation for the order routed on the card of Fig. 5. These forms are sufficiently clear in themselves so that detailed explanation is unnecessary.

Mention has been made that as the organization became skilled in operating under the new system the number of persons in the planning department was reduced from three to one. At the outset this department started to perform all the functions which would be required in a medium-size or large factory. The work was divided among three clerks who handled the orders from their receipt from the sales department through the making out of the manufacturing order, routing cards, time tickets, stores issues, to the figuring standard times and bonuses on each operation, designating the most economical materials, etc. Through gradual refinement, however, this work has been so

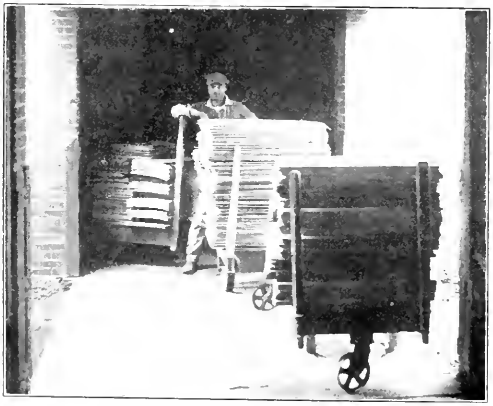


FIG. 8 TRUCK LOADS OF VENEER TAKEN OUT FOR ORDERS

reduced that one man now handles the entire routing, even to making out the pay-roll sheet. This advantageous result has been made possible due to the close co-operation between this man in the planning department and the shop foreman. The latter, who actively follows the work through the shop, is now so familiar with the complete routine that in case of necessity this foreman can carry on all of the inside work without difficulty.

The Results Secured

In an earlier paragraph of this paper the general advantages secured from this improvement in management were listed under six headings. To itemize these results and present additional detail, the following advantages can be credited directly to the engineering work done:

1. Demurrage on cars waiting for ends was stopped.
2. Shipments to customers were more prompt and the customers were kept better satisfied.
3. Overtime in certain departments and corresponding slack periods were eliminated.
4. The material and work in process could be controlled by the management at all times.
5. Accurate material and direct labor costs on each order were possible when desired.
6. The pay-roll was checked against the productive time.
7. Several so-called sub-foremen or gang bosses were rendered unnecessary and men were put on to production work.
8. Indirect labor was closely checked and considerably reduced.
9. Production of the various machines was increased—some as much as 50 per cent.
10. Earnings of employees increased some 22 per cent.
11. Labor cost was reduced some 17 per cent.
12. Morale of organization considerably improved. Also reduced labor turnover and improved attendance.

Figs. 9, 10, and 11, show three principal operations in making a veneer box, including cutting off the veneer, tenoning the end cleats, and making the mat.

The Bonus Plan

To show the way in which the basic information for the bonus plan was worked out three tables are in-

TABLE 1. BONUS TABLE FOR [illegible]

[illegible]															
25	0.17	.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	[illegible]	[illegible]	[illegible]
50	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.23	0.23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	0.27	0.27	[illegible]	0.27	0.27	0.27	0.27	[illegible]	[illegible]	0.28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
300	0.29	0.29	[illegible]	0.29	0.29	0.29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	0.31	[illegible]	[illegible]	[illegible]	0.31	0.31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
400	0.33	[illegible]	[illegible]	[illegible]	0.33	[illegible]	0.34	[illegible]	0.34	0.34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	0.35	[illegible]	[illegible]	[illegible]	0.35	[illegible]	0.36	0.36	0.37	0.37	[illegible]	0.38	[illegible]	0.40	[illegible]
500	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.42	0.42	0.43	0.43	0.44	[illegible]	0.46
50	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.41	0.45	0.45	0.46	0.46	0.47	0.48	0.49
600	0.42	0.42	0.42	0.42	0.42	0.42	0.43	[illegible]	0.47	0.48	0.48	0.49	0.50	0.51	0.52
50	0.47	0.47	0.47	0.47	0.47	0.47	0.48	0.48	0.49	0.50	0.51	0.51	0.52	[illegible]	[illegible]
700	0.49	0.49	0.49	0.49	0.49	0.49	0.50	0.50	0.51	0.52	[illegible]	[illegible]	0.54	[illegible]	0.57
50	0.51	0.51	0.51	0.51	0.51	0.51	0.52	0.52	[illegible]	0.54	[illegible]	0.56	0.57	[illegible]	[illegible]
800	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.55	[illegible]	0.57	0.58	0.58	0.59	0.61	0.62
50	0.55	0.55	0.55	0.55	0.55	0.55	0.56	0.57	0.58	[illegible]	0.60	0.61	.62	0.64	[illegible]
900	0.57	0.57	0.57	0.57	0.57	0.57	0.58	0.59	0.60	0.61	0.62	[illegible]	[illegible]	[illegible]	[illegible]
50	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.61	[illegible]	[illegible]	0.67	0.68	[illegible]	0.72	0.74
1000	0.62	0.62	0.62	0.62	0.62	0.62	[illegible]	0.64	0.68	[illegible]	[illegible]	0.71	[illegible]	0.75	0.77
50	0.64	0.64	0.64	0.64	0.64	0.64	0.65	[illegible]	0.70	0.71	0.72	0.73	0.74	0.77	0.79
1100	0.66	0.66	0.66	0.66	0.66	0.66	0.67	0.68	0.72	0.73	[illegible]	0.76	0.77	[illegible]	0.82
50	0.68	0.68	0.68	0.68	0.68	0.68	0.69	0.70	0.74	0.75	0.77	0.78	0.80	0.82	0.85
1200	0.71	0.71	0.71	0.71	0.71	0.71	0.72	0.73	0.76	0.78	0.80	0.81	[illegible]	0.85	0.88
50	[illegible]	0.76	0.76	0.76	0.76	0.76	0.77	0.78	0.79	0.80	0.82	[illegible]	0.85	0.87	0.90
1300	0.78	0.78	0.78	0.78	0.78	0.78	0.79	0.80	0.81	0.82	0.84	0.86	0.88	0.90	0.93
50	0.80	[illegible]	0.80	0.80	0.80	0.80	0.81	0.82	0.83	0.84	0.86	0.88	[illegible]	0.92	0.95
1400	0.82	0.82	0.82	0.82	0.82	0.82	0.84	0.85	0.88	0.89	0.91	0.94	[illegible]	0.98	1.01
50	0.84	0.84	0.84	0.84	0.85	0.85	0.86	0.87	0.91	0.92	0.94	0.97	0.98	[illegible]	1.04
1500	0.86	0.86	0.86	0.86	0.87	0.87	0.88	0.89	0.93	0.94	0.96	0.99	1.00	[illegible]	[illegible]
50	0.88	0.88	0.88	0.88	0.89	0.89	0.90	0.91	0.95	0.97	0.99	1.02	[illegible]	1.06	[illegible]
1600	0.90	0.90	0.90	0.90	0.91	0.91	0.93	0.94	0.97	0.99	1.01	[illegible]	1.05	1.08	[illegible]
50	0.92	0.92	0.93	0.93	0.94	0.94	0.95	0.96	1.00	1.02	1.04	1.07	1.08	1.11	1.14
1700	0.94	0.94	0.95	0.95	0.96	0.96	0.97	0.98	1.02	1.04	1.06	1.09	1.10	1.13	1.16
50	0.96	0.96	0.97	0.97	0.98	0.98	0.99	1.00	1.04	1.06	1.08	1.11	1.13	1.16	1.19
1800	0.99	0.99	1.00	1.00	1.01	1.01	1.02	1.03	1.06	1.08	1.10	1.13	1.15	1.18	1.21
50	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.08	1.11	1.13	1.15	1.18	1.20	1.24	1.27
1900	1.06	1.06	1.07	1.07	1.08	1.08	1.09	1.10	1.14	1.16	1.18	1.21	1.23	1.27	1.30
50	1.08	1.08	1.09	1.09	1.10	1.10	1.11	1.12	1.16	1.18	1.20	1.23	1.26	1.30	1.33
2000	1.10	1.10	1.11	1.12	1.12	1.12	1.13	1.14	1.19	1.21	1.23	1.26	1.29	1.32	1.36
50	1.12	1.12	1.13	1.13	1.14	1.15	1.16	1.17	1.21	1.23	1.25	1.28	1.31	1.34	1.38
2100	1.14	1.14	1.15	1.15	1.16	1.17	1.18	1.19	1.24	1.26	1.28	1.31	1.34	1.37	1.41
50	1.17	1.17	1.17	1.17	1.18	1.19	1.20	1.21	1.26	1.28	1.30	1.33	1.36	1.39	1.43
2200	1.19	1.19	1.20	1.20	1.21	1.21	1.22	1.23	1.29	1.31	1.33	1.36	1.39	1.42	1.46
50	1.21	1.21	1.22	1.22	1.23	1.24	1.25	1.26	1.31	1.33	1.35	1.38	1.41	1.44	1.48
2300	1.22	1.24	1.25	1.25	1.26	1.26	1.27	1.28	1.36	1.38	1.40	1.43	1.46	1.50	1.54
50	1.25	1.26	1.27	1.27	1.28	1.28	1.29	1.30	1.39	1.41	1.43	1.46	1.49	1.53	1.57
2400	1.28	1.29	1.30	1.30	1.31	1.31	1.32	1.33	1.41	1.43	1.45	1.48	1.51	1.55	1.60
50	1.33	1.34	1.35	1.35	1.36	1.36	1.37	1.38	1.44	1.46	1.48	1.51	1.54	1.58	1.63
2500	1.35	1.36	1.37	1.37	1.38	1.38	1.39	1.40	1.46	1.48	1.50	1.53	1.57	1.62	1.66

cluded, the first for rip-sawing, the second for printing, and the third for box-making. These tables in blue-print form are posted in the shop for reference by the operators and for their use in figuring the amount of the individual bonus. Along the wall at the rear in Fig. 13, a number of these bonus tables are seen hanging across the lower part of the window openings.

The Bonus for Rip-Sawing

Material

1. Rotary cut veneer reaches plant in following condition:
   (a) Thickness: 1/6 in., 3/16 in., 1/4 in.
   (b) Widths: 16 1/2 in. and 20 in. (regular widths).
      1. Special width: 13 1/2 in.
      2. Cut-down stock to a minimum of 4 in.
   (c) Lengths: 30 in. to 60 in. by multiples of 2 in. and special lengths. Some lengths arrive in half lengths. Example: 27 in. is the same as 54 in.
   (d) Wired in bundles: 1/6 in. and 3/16 in. 30 pieces to the bundle. 1/4 in. 25 pieces to bundle.

Manufacturing Operations

2. The following manufacturing operations are performed:
   (a) On receipt of stores issue, storekeeper loads and delivers veneer to saws.

[illegible]

2. [illegible]

3. [illegible]

4. [illegible]

5. [illegible]

6. At [illegible] with [illegible] tables [illegible] pipes [illegible] Automatic Cut-off [illegible] truck of veneer to [illegible] to his own saw.

(c) Off Bearer:
1. Takes ripped veneer as it comes through the saw and places it on truck.
2. Places offal strips in wheelbarrow, for inside crates, if wide enough; for trash pile otherwise.
3. Oils saw and cleans around saw, while sawyer is setting up saw or marking load.

The way in which the wages are computed, using the data in regard to rip-sawing, is given in Table 1 as follows:

1. *Following Rules Govern Payment of Wages and Bonus*

   Employee is paid his *regular rate* for the *time* he *actually works* (regardless of whether he earns or fails to earn his bonus).

   He will receive *bonus* on the *time allowance* (whenever the work is done within the time allowed).

2. *Time to Allow*

   Each time shown in the tables, includes time for
   Setting up saw (once).

FIG. 9 THE OPERATION OF CUTTING OFF

TABLE 2 BONUS TIME FOR PRINTING
- TIME IN HOURS

No of Prints	Time	No of Prints	Time	No of Prints	Time	No. of Prints	Time	No of Prints	Time
50	0.12	2,050	0.92	4,050	1.72	6,050	2.52	8,050	3.32
100	0.14	100	0.94	100	1.74	100	2.54	100	3.34
150	0.16	150	0.96	150	1.76	150	2.56	150	3.36
200	0.18	200	0.98	200	1.78	200	2.58	200	3.38
250	0.20	250	1.00	250	1.80	250	2.60	250	3.40
300	0.22	300	1.02	300	1.82	300	2.62	300	3.42
350	0.24	350	1.04	350	1.84	350	2.64	350	3.14
400	0.26	400	1.06	400	1.86	400	2.66	400	3.46
450	0.28	450	1.08	450	1.88	450	2.68	450	3.48
500	0.30	500	1.10	500	1.90	500	2.70	500	3.50
550	0.32	550	1.12	550	1.92	550	2.72	550	3.52
600	0.34	600	1.14	600	1.94	600	2.74	600	3.54
650	0.36	650	1.16	650	1.96	650	2.76	650	3.56
700	0.38	700	1.18	700	1.98	700	2.78	700	3.58
750	0.40	750	1.20	750	2.00	750	2.80	750	3.60
800	0.42	800	1.22	800	2.02	800	2.82	800	3.62
850	0.44	850	1.24	850	2.04	850	2.84	850	3.64
900	0.46	900	1.26	900	2.06	900	2.86	900	3.66
950	0.48	950	1.28	950	2.08	950	2.88	950	3.68
1,000	0.50	3,000	1.30	5,000	2.10	7,000	2.90	9,000	3.70
50	0.52	50	1.32	50	2.12	50	2.92	50	3.72
100	0.54	100	1.34	100	2.14	100	2.94	100	3.74
150	0.56	150	1.36	150	2.16	150	2.96	150	3.76
200	0.58	200	1.38	200	2.18	200	2.98	200	3.78
250	0.60	250	1.40	250	2.20	250	3.00	250	3.80
300	0.62	300	1.42	300	2.22	300	3.02	300	3.82
350	0.64	350	1.44	350	2.24	350	3.04	350	3.84
400	0.66	400	1.46	400	2.26	400	3.06	400	3.86
450	0.68	450	1.48	450	2.28	450	3.08	450	3.88
500	0.70	500	1.50	500	2.30	500	3.10	500	3.90
550	0.72	550	1.52	550	2.32	550	3.12	550	3.92
600	0.74	600	1.54	600	2.34	600	3.14	600	3.94
650	0.76	650	1.56	650	2.36	650	3.16	650	3.96
700	0.78	700	1.58	700	2.38	700	3.18	700	3.98
750	0.80	750	1.60	750	2.40	750	3.20	750	4.00
800	0.82	800	1.62	800	2.42	800	3.22	800	4.02
850	0.84	850	1.64	850	2.44	850	3.24	850	4.04
900	0.86	900	1.66	900	2.46	900	3.26	900	4.06
950	0.88	950	1.68	950	2.48	950	3.28	950	4.08
2,000	0.90	4,000	1.70	6,000	2.50	8,000	3.30	10,000	4.10

In addition to net times as shown in above tables add the following times:
0.05 Change ticket
0.13 Change from one die to one die.
0.17 Change from one die to two dies
0.17 Change from two dies to one die.
0.20 Change from two dies to two dies.
0.11 Add if rollers are taken out and cleaned.

Cutting wires (according to number of bundles).
Ripping (according to number of pieces).
Changing trucks (according to number of pieces).

In addition to the sawing time, 0.05 hr. is allowed for changing ticket.

Tables are figured to 2500 pieces daily. Any quantity above 2500 pieces should be figured by taking the value for the nearest full truckload and adding to it the value for the difference between quantity in the nearest full truckload and the quantity called for.

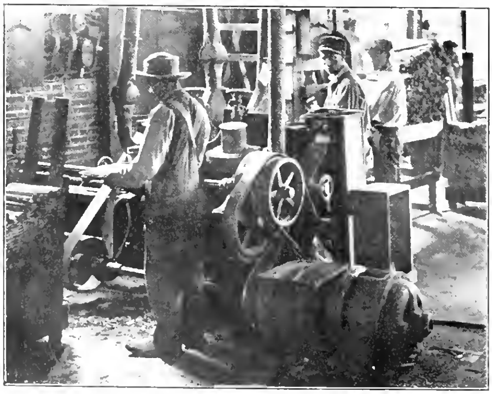


FIG. 10 THE OPERATION OF TENONING

3. *Allowance for Abnormal Delays*

Bonus will be paid on the net times taken from tables provided quality of work is O K. When foreman signs ticket, he O K's the quality.

Any abnormal delays should be allowed for in figuring whether bonus has or has not been made. Examples of abnormal delays are:

Power off.

Error in cutting instructions, etc.

In case of any major breakdown of the saw, sawyer and off-bearer should be transferred immediately to 814 and maintenance department notified to make repairs. Allow 0.15 hr. for this change. This 0.15 hr. includes, "Move to Saw" and "Set up Saw."

The abnormal delays should be reduced to a minimum, as they are costly to both sawyer (in lack of opportunity to make bonus) and management (in curtailment of production). When they do occur, however, they should be listed on the back of the ticket, together with the time lost, so it may be deducted from the time actually taken.

TABLE 3. BONUS TIME FOR BOX-MAKING
Based on a 2.3 Inch Stitch

Size	Min. In. per Hr.	Per Cent of Hourly Rate	Bonus per M In. Above Min. per Hr.				
			Operator	Board Layer	Cut-Off	Stocker	Cleat Layer
1	10885	9.187	2.66	2.15	1.98	1.84	1.38
2	10466	9.540	2.77	2.24	2.05	1.91	1.43
3	10047	9.893	2.87	2.33	2.13	1.98	1.48
4	9628	10.246	2.97	2.41	2.20	2.05	1.53
5	9209	10.599	3.07	2.49	2.28	2.12	1.59
6	8790	10.952	3.18	2.57	2.35	2.19	1.64
7	8371	11.305	3.28	2.66	2.43	2.26	1.69
8	7952	11.658	3.38	2.74	2.51	2.33	1.75
9	7533	12.011	3.48	2.82	2.58	2.40	1.80
10	7114	12.364	3.59	2.91	2.66	2.47	1.85
11	6695	12.717	3.69	2.99	2.73	2.54	1.91
12	6276	13.070	3.79	3.07	2.81	2.61	1.96

Actual In. Run of Different Length Stitch by Factor Corresponding	
Stitch	Factor
1.5	1.53
1.6	1.44
1.7	1.35
1.8	1.28
1.9	1.21
2.0	1.15
2.1	1.09
2.2	1.05
2.3	1.00
2.4	.96
2.5	.92
2.6	.88
2.7	.85
2.8	.82
2.9	.79
3.0	.77

The instructions for setting up the printing press for printing either sides or ends of boxes are these (See Table 2):

1. *Make Ready*
   (a) Operator
      1. Take out dies.
      2. Put in new dies.
      3. Take out or put in rollers.
      4. Adjust ready to print.
   (b) Off-bearer
      1. Get new die or dies.
      2. Clean die just used.
      3. Clean rollers.
      4. Put in or take out ink.
2. *Press*
   (a) Operator feeds stock to printer, placing it in slide so that plunger will carry on each throw.
   (b) Off-bearer takes printed stock from receiving table and loads on truck.
   (c) Operator and off-bearer shift trucks. Full truck to box machine or in clear for the next load.
   (d) Sorters sort the stock before going to press. The culled stock, that which is too short, narrow, knot holes, etc., is laid aside and not printed, so that it may be ripped into the same or some other order and not wasted.

Change from one die to one die.

0.84—Remove die.

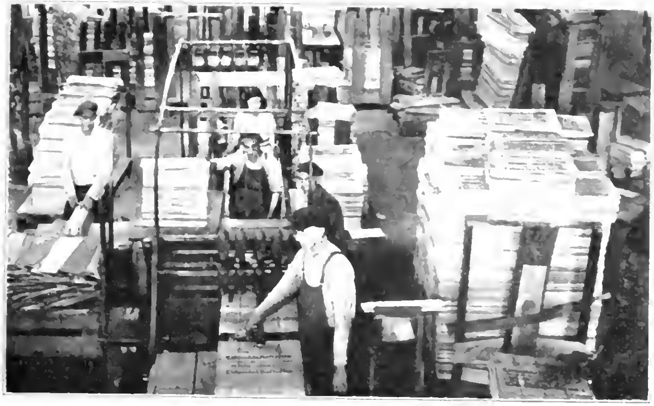


Fig. 11 The Op[illegible] of M[illegible] Mak[illegible]

2.10 Place new die.
4.00 Adjust ready to print.

6.94
.69 10 per cent for miscellaneous delays.

7.63 Total set up time (min.)
0.13 Total set up time (hr.)

Table 3 in similar form gives the bonus factors for the various parts of the crew of the box-making machine. The standard production from the box-making machine is 10,000 in. of mat per hr., or 90,000 in. for a 10-hr. day. For every 1000 in. over 90,000 in. per day, there is an increased bonus rate. This is modified by several factors. For instance, the bonus [illegible] day [illegible] There is [illegible] between the engineer [illegible] shown [illegible] right of Table 3.

The [illegible] thousand [illegible] per hour [illegible] bears a relationship to the hourly wage rates as follows. For operator 29 cents per hr.; board layer 23½ cents; cut off, 21½ cents; stacker, 20 cents; cleat layer, 15 cents.

It is intended that the opportunity to earn a bonus shall be such that the bonus will add about 40 per cent to the hourly rate of each worker. The bonus added to the hourly wage gives a total above the prevailing rate for similar work in the locality.

The results secured at our Crawfordsville plant are quite in keeping with those which have been described for the shop at East St. Louis. The success of a development such as I have outlined is only possible when the details of planning and control and the details of standards through job analysis, as well as time study, are worked out to fit the particular needs of a particular plant. The element of working with and through the workmen so that they understand in their own way the practicability and economy of the new procedure as well as seeing whereby they are benefited financially, is the factor not realized by most executives and but few engineers. Furthermore our experience is proof of the advantages of an analytical study of all operating conditions and management methods without reference to the size of plant or nature of product.

To forestall any possible misunderstanding let me add that the management installation is incomplete, due to our failure to carry the job analysis work through into every operation in the plant which is subject to such analysis. In time we expect to have an individual bonus on each direct machine operation.

REPORT ON INTERRUPTIONS

RECEIVED

REPORT ANY DELAY HOLDING UP PROGRESS OF WORK, WAITING TIME AFFECTING BONUS OPERATORS, DAMAGE TO MATERIALS, MACHINE REPAIRS, OR CHANGES.

MONTH DAY YEAR

SCHEDULE MAN

PROGRESS OF WORK ON ORDER No.

NOW IN OPERATION AT

IS HELD UP BECAUSE OF

DELAY

CHANGE

WAITING

REPAIRS

DAMAGE, IF ANY

CAUSE

REMARKS:

EMPLOYE'S NAME No.

OPERATION

REPORTED BY

INSPECTOR IN CHARGE

CHIEF INSPECTOR

PRODUCTION MANAGER	SCHEDULE MAN	ROUTE MAN	PAY ROLL MAN	SUPERINTENDENT	

Fig. 12 Form for Report of Interruptions

Fig. 13 A Corner of the Shop Showing Bonus Prints on the Windows

It will make for even better conditions than we now have.

In developing the same work in other plants and building upon our past experience I should put more emphasis upon a premium for reduction in waste of materials and possibly less premium upon quantity of production. Ours is a business in which more than one-half of the total cost is raw materials, and less than 15 per cent is labor. I believe our engineering friends can do a great deal with us in developing a comparison of the premiums for reduction in material waste along with increased quantity production.

A Worker's Idea of Job-Hunting and Holding

By BILL HALEY

Class Number
658.4 Employment Management
658.4151 Centralized Employment Office

A MANUFACTURING city is laid out like a great big wheel. The hub is the mercantile or business center. The manufacturing plants, being located on the outskirts of the city, naturally form the circumference.

In searching for employment a man starts out anywhere on the rim, and travels all the way round, or until he gets tired or discouraged. He, therefore, has to travel three times the diameter of the city. All conveyances converge toward the center of the city, so he cannot ride. There would be so many stops he could not spare the time, and so many fares to pay that he could not afford it, anyway. Some employment interviewers, moreover, make him wait a long time for a five-minute interview, and prevent him from getting to another plant where he might land a job.

Why not have an employers' co-operative employment office located in the center of the city? There would be a noticeable reduction in the cost of securing data. It would be necessary to have only one card catalogue system, instead of one for every plant in town. A few definite hours would be sufficient for the hiring period. Then a man could go home and work around the house if he knew there were no jobs open that day. Other hours could be allotted to the treatment of shop accidents; to the adjustment of compensation cases; to the cases of those who are discharged or quit; and to the exchange of ideas pertaining to employment and safety devices.

A group of employers could easily afford a desk for each of their employment interviewers. They could secure the services of a vocational expert, to fit the square pegs and the round pegs in their proper places. One examining physician would be able to take care of all acceptable applicants.

Data could be more easily gathered and compared. The workingman would be more contented because he could go to one definite place and see all the employers in town at the same time. There is nothing so discouraging as to be wearing out shoeleather looking for a job. Any workman will tell you that it is much harder to seek for work than it is to do it after he gets the job.

After all, executives should stop worrying so much about the man they are going to hire, and think more of the man who has been in their employ for some time. First let me tell you why. I have asked thousands of employees: "Why don't you take a little more interest in your work?" The answer, with a few exceptions, has been: "Nobody seems to care any more in this plant for a man that starts to work half an hour ahead of the rest. I notice that the fellow who is least interested in landing the job is generally the lucky one that gets it."

Sometimes they say: "Look here, Bill, you must be kidding me. I've been coming to work half an hour early, and staying over 15 to 20 minutes to fix everything shipshape for the morning. If you ever noticed George, you'll remember that he used to do the same. Yet George was one of the first to get laid off." So I couldn't help but think that those stories in the books of the fellow that always took a little more interest in his work and in this way gained the good-will of his employer, must have been exceptional instances.

The part that the employee wishes to play in plant management is based merely on the idea that he does not think that the employment end of the organization is properly handled. If you work in with men day in and day out, play the game fair, and not just visit them, you will find that what the workers want most is recognition of ability. That is why a pat on the back by some foreman has often accomplished wonders.

If the workman is certain that the employment office is using any kind of follow-up system in the plant, he will be sure that his own individual ability is going to be recognized. That is as far as he wants to go in the management of the affairs of the plant.

There are men in every walk of life who have no particular ability in any definite direction, yet by some mysterious manner which I will not pretend to be able to explain, they seem to get ahead of the rest. The question arises: "How in the world do they do it?" What the employee expects of the employment department is to sort out men who have real ability and give them a chance at the good jobs. He thinks that the employment department is falling down on the job if they do not do it.

In the opinion of the average workman, the employment department keeps track of a man only when they are hiring or firing him. They lose interest in him in the period of time which elapses between the time he is hired and the time he is fired or quits. As soon as the employee finds that you are losing interest in him you will discover that he is losing interest in you and your plant.

If men had a fair chance to get jobs they liked and deserved there would be less dissatisfaction and labor turnover in manufacturing plants.

The Monthly Financial Budget

"How the Walworth Company Looks Ahead" Article Four

By JOSEPH H. BARBER

[illegible] Walworth [illegible]

Class Number
658.14 Factory Budget Systems
338.97 Forecasting Production

MODERN industry, in demanding centralized control of many geographically separated operating units, requires its administrators to extend their effective control in the face of diminishing means of natural control. The present-day administrator of such a group of scattered operating units lacks that natural means of control which his forerunner possessed—the daily "trip through the plant." That daily trip had advantages hard to replace:

1. He could "*feel* how things were going." Through personal contact, he could inspire obedience and could sense the quality of response to his directions.
2. He could "*see* how things were going." Through personal presence, the trained eye could observe accomplishment, the status of stocks on hand, and general efficiency.

The first advantage is retained to the modern administrator through inspirational correspondence, visiting trips to the local units, and executive conferences at headquarters. Through the confidence he thus inspires in his men, he may feel assured that all is well in general. But beyond this, he must "see," or visualize as in a picture, no less than did his forerunner in that daily trip, the net effect of his varied activities, and the extent to which plans have matured into desired accomplishment.

The Reason for "Budgetary Procedure"

To gain this second advantage, industrial administrators have been advised to install "budgetary procedure." To most administrators the term suggests red tape, excessive overhead expense, and a waste of subordinates', as well as superiors' time, out of all proportion to the value which can assuredly be derived. Certainly, if this "budgetary procedure" be extended to involve detail comparable with that necessary for governmental control of expenditure, few administrators would give ear to the advice—and wisely. But, fortunately, the idea itself, without its extended refinements, may be utilized. Neither excessive time nor unwarranted expense are necessarily involved in assuring a very definite control, the value of which cannot be tabulated in dollars alone.

This article is to present our budgetary procedure, which heads up under our planning and statistics section, a staff section of the president's office. The full time of two clerks only is required in execution of the estimate analysis and summary procedure described here, and in the compilation of all the periodical statistical reports to be described in the next article. On the part of those who submit the estimates of their contemplated performance, the only time consumed (and this by the estimating executive himself), is that which should be spent at least once each month in review of his current status, and in determining his desirable future course.

However, before adopting our budgetary procedure, many of our executives did not go thoroughly enough into this periodical analysis of their own jobs. Of course, the requirement from headquarters to estimate their future at first proved irksome. Nevertheless, the statement of one of our executives is typical of the ultimate reaction: "I never really had a grip on my job until I was compelled to estimate its future for the budget." As will be evident from the description to be given, this control device retains for us the second advantage mentioned above. The estimator knows he is being "seen," though the manager who does "see how things are going" may present himself in physical form only at infrequent intervals.

The Foundation of the Budget

Earlier articles have suggested, in turn, how we secure the long-time look ahead—our location within the business cycle; how we anticipate the year's sales in advance; and how, quarterly, through the year, we reestimate sales for co-ordinating sales and production.

These, however essential, do not constitute full control. They provide the basis for feeding coal to the boilers, as it were, in order that steam at ample pressure and in suitable quantity may be available at all steam consuming devices, when and as required. Yet the complete steam system is not just a matter of connecting boilers and consuming devices. There are, in addition, many auxiliaries or accessories necessary as an aid in the production and effective consumption of the steam. Boilers, consuming devices and accessories, as a whole, are an economic unit and operate most efficiently at a predetermined pressure, temperature, or steam consumption rate. To assure this adjustment, thermostat control devices are introduced. Each such device, in its sphere of action, either maintains a standard of assured balance, or warns of an undesirable variation in time to permit adjustment before damage is done.

Our monthly budget of sales, purchases, pay-rolls, cash and inter-unit transactions, serves the purpose of the thermostat in our business. It is not, however, of the automatic self-regulating type. Rather, it is of the continuous recording type, which provides a detail record designed so that managers may "see how the business is going," and which is presented at monthly

TABLE 1. ESTIMATE OF SALES, CASH RECEIPTS AND INTER-COMPANY CASH DISBURSEMENTS

New York Branch
Unit of Company

For Month of July, 1923.

No	Item	Actual for April	Original Est for July	Revised Est. for July
	A Sales	B	C	D
1	Amount of other O S sales to customers	00,000	00,000	....
2	Amount of pipe sales to customers (both owned and consigned) . . .	00,000	00,000	. . . .
3	Total O S sales to customers (Items 1 and 2 combined)	00,000	00,000	. . . . . .
4	Amount of D S pipe to customers . .	0,000	0,000	. .
5	Amount of all other D S sales to customers from O V.	0,000	0,000	. .
6	Amount of all sales from inter-company sources.	00,000	00,000	
7	Total D S sales to customers (Items 4, 5 and 6 combined)	00,000	00,000	
8	Total billings to customers (Sum of Items 3 and 7)	000,000	000,000	. . . . . .
9	Billing against other units of the company.	0,000	0,000	. . . .
	Cash Receipts			
10	Cash receipts from collections of customer's accounts, notes, etc. . .	000,000	000,000	....
11	Cash receipts from other outside sources, if any . .	000	000	....
12	Total.	000,000	000,000	......
	Inter-Company Disbursements			
13	Cash disbursed to other units of the company	0	0	....

Approved by———————————
Branch Manager

Date, June 18, 1923.

intervals in time to direct a stimulating or restraining influence to the exact point of the system where such influence is needed.

To insure an analytical reading of the thermostatic record when it is presented to the busy controlling officers, the form of the budget is kept simple. The master summary is contained upon a single letter-size sheet. Its summarizing figures are so arranged that, for control purposes, each unit of the organization may be analyzed as an independent business in the same instant that reference may be made to its interrelations with the business as a whole.

The summary provides basic material for controlling the cost or expense (including pay-roll) of all units, the raw materials purchases of the works, and the finished material purchases of the merchandizing units (which deal also in purchased products of other manufacturers).

All these commitments requiring control, are controlled in terms of their relation to the estimated sales, to secure which, it is to be inferred, we become obligated for the commitments. Finally, the budget as set up indicates the resulting cash conditions and gives the treasurer advance notice of probable cash requirements 60 days hence.

Our present practice has been designed to conform to the accepted budgetary requirements:

1. To establish responsibility.
2. To effect accountability.
3. To estimate probability.
4. To determine advisability.
5. To insure desirability.
6. To check up ability.

The first refers to the organizational line-up and the second to the line-up of accounting to reflect performance under clearly defined organizational jurisdictions. Both these initial requirements, in a certain sense, are not requirements of budgetary procedure alone; they are indeed requirements of any well-managed business. But they are vital to the success of any budgetary plan, and these initial requirements must be met before later steps are attempted.

In attempting to meet these initial requirements in our case, it was not an easy matter at once to define clearly the functions of the major executives, but agreement upon divisions of authority was finally reached. Our present organization comprises three line vice-

TABLE 2. ESTIMATE OF PURCHASE INVOICES TO BE RECEIVED OTHER THAN FOR EXPENSE AND OF DISBURSEMENTS FOR PURCHASES

New York Branch
Unit of Company

For Month of July, 1923

No.	Item	Actual for April	Original Estimate		Revised Estimate	
			Accrued	Disbursed	Accrued	Disbursed
	A	B	C	D	E	F
1	Purchases of resale material from outside vendors for stock, or on "pick-up" orders Include invoices chargeable to accounts: FW—Walworth product F12—Wrought pipe (except that included in Item 2) F 8—Plumbing goods F10—All other resale material.	00,000	00,000	00,000	....	....
2	Purchase cost of all owned or consigned pipe from outside vendors (except D S and "pick-up" pipe)	00,000	00,000	00,000	....	....
3	Purchase cost of D S pipe from O/V.	0,000	0,000	0,000	....	....
4	Purchase cost of direct shipment from O/V (except pipe, etc., included in item above). Includes invoices chargeable to accounts: Cost of sales Walworth product Cost of sales plumbing goods Cost of sales all other resale material . .	0,000	0,000	0,000	....	....
5	*Extraordinary Purchases Equipment — Paid by General Office* Includes all items chargeable to capital accounts but paid by general office	0,000	0	0	....	....
6	*Extraordinary Purchases Equipment — Paid by Branch* Includes all items chargeable to capital accounts, but paid by branch	0	0	0,000	....	....
7	*Deferred Charges.* Includes all items such as insurance premiums and taxes, if invoice to be received by, and chargeable to branch, but forwarded for payment by General Office. . .	000	000	000	....	....
8	Total purchases from outside vendors . . .	00,000	00,000	00,000	....	....
9	Inter-company purchases of all groups of merchandise for inventory.	00,000	00,000		....	....
10	Inter-company purchases of all groups of merchandise for direct shipment	00,000	00,000		....	....
11	Total purchases. .	000,000	000,000		....	....

Approved by———————————
Branch Manager

Date, June 18, 1923.

TABLE 3—ESTIMATE OF THE EXPENSE OF NEW YORK BRANCH

For Month of [illegible] 1923

No.	Item	Actual for Month	Original Estimate Accrued	Original Estimate Disbursed	Revised Estimate Accrued	Revised Estimate Disbursed
No.	A	B	C	D	E	F
1	*Pay-rolls—Salary Class* Includes the compensation of all personnel in the salary class except those paid from the general office. This class of compensation is chargeable to the -50, -52 and -56 accounts	0,000	0,000	0,000		
2	*Pay-rolls—Wage Class* Includes the compensation of all personnel in the wage class. This class of compensation is chargeable to the -55 account	0,000	0,000	0,000		
3	*Pay-roll—Commissions* Includes all payments made to any employee for commissions, chargeable to the -51 account	000	000	000		
4	*Expense Purchases* (Paid by Branch) For outside vendors' material or services chargeable to accounts: -60 Repairs and replacements of miscellaneous equipment; -67 Donations, etc.; -70 Machinery repairs; -78 Telephone and telegraph; -81 Association memberships; -82 Rental; -83 Postage; -84 Packages, crates; -85 Supplies, etc.; -86 Fuel; -87 Advertising local; -88 Cartage and freight; -90 Travel; -91 Power, light, heat; -94 Credit and collections; -98 Insurance and taxes (If paid by the branch and entirely written off in one month)	0,000	0,000	0,000		
5	*Expense Purchases* (Paid by General Office) For outside vendors' material or services chargeable to any of accounts listed in "4" above, particularly rent, if any, stationery, etc., contracted for locally but disbursed at the general office	0,000	0,000	0,000		
6	*General Office Expense Apportioned*	000	000	000		
7	*Other Inter-Company Expense* Includes all charges to any of the accounts listed in "4" above, due to inter-company purchases of "expense" materials contracted for and stocked by other units	000	000			
8	*Other Inter-Company Service Charges* Includes all charges to any of the accounts listed in "4" above, due to inter-company charges for bookkeeping, collection or other "services" performed by another unit	0	0			
9	*Fixed Charges* Includes monthly apportionments chargeable to the following accounts: -97 Depreciation; -98 Insurance and taxes	000	0,000			
10	*Credits to Expense* Includes all credits to expense account rental received, charges for packing, services rendered, etc., which are creditable to the -99 account	00	0			
11	Total Branch Expense	00,000	00,000	00,000		

presidents—one in charge of production, one in charge of sales, and a third in charge of [illegible] functions. In addition, because our business has many technical aspects, a fourth vice president in [illegible] capacity heads up all functions pertaining to engineering. There are of course the other usual [illegible] officers—secretary and treasurer. These [illegible] officers, in contact with the president's office, [illegible] control of all branches of the business. Each officer is given full authority for directing all activities within his control, and is held responsible for financial results. Accordingly, our accounting system is designed to classify, record, and evaluate these financial results.

Moreover, activities coming within the jurisdiction of each of these vice presidents are broken down so that every subordinate knows his authority and responsibility. The major executives under the vice-president in charge of production, for instance, are the Boston works manager, and the Kewanee works manager. Under each of these managers is a complete but distinct organization, and the accounting system is arranged to correspond with the authority of these officers.

As a part of the regular accounting procedure, each works and each merchandizing unit has its own accounting records. From these records are constructed monthly financial statements and from the expense accounts, separately kept for each department, are provided monthly detail expense analyses for each executive.

This plan of organization and the development of such an accounting system thus fulfils the initial requirements for budgetary control. And, furthermore, it will continue as an essential for control purposes that the company, no matter how rapidly it may develop, shall always be just as easy to comprehend as the original smaller organization. Responsibilities must be so clearly marked that there can be no side-stepping the results indicated by the accounting records. This is the necessary foundation for any budgetary procedure which is competent to provide continuously definite indications of the present status of the business and of its future trend.

When such an organization had been established for a few years, each executive had accumulated a fund of accounting records of his past performance—his safest guide in estimating his future performance. For control of his own work, he learned that much of his accounting detail could be conveniently summarized into significant interrelated groups. A continuing study of these groups has shown him that many ratios of performance have a surprising constancy in spite of the great changes in volume. Therefore, so far as he used them, these operating ratios became a valuable aid in co-ordinating the details of his own production or merchandizing plan for the future.

We were ready, then, to establish a budgetary procedure for utilizing this background of past data in the hands of the executives most closely in touch with local conditions, and best able to use it. However, the present procedure was at no time heralded through issue of a bulky or formal manual. It has resulted from a slow and natural growth. It has been increased in scope as the local executives who contribute the estimates have been able to assimilate more of the

TABLE 4. SUMMARY REVIEW SHEET OF ESTIMATED JULY 1923, SALES

			Data of Past Months			This Month Original Estimates		Relevant Statistics					Executive Revisions of Estimates		
			Act. Sales 2d Prev. Month May	Final Est. Next Prev. Month June	Actual 15 Days' Sales June	$17,000,000 Quota	Unit's Own Estimate July	Per Cent Out of Stock: Unit's Est.	Per Cent Out of Stock: Latest 3 Mos	Usual Per Cent Over Prev. Months: 2d Prev.	Usual Per Cent Over Prev. Months: Next Prev.	Per Cent Actual Usually Exceeds Unit's Est.	By V. P. of Sales	By Asst. to President	By President
Divisions	Eastern		000,000	000,000	00,000	000,000	000,000			0	00	0	000,000	000,000	000,000
	Western		000,000	000,000	000,000	000,000	000,000			0	00	0	000,000	000,000	000,000
	Total Divisions		000,000	000,000	000,000	000,000	000,000						000,000	000,000	000,000
Branches	Boston	O/S	000,000	00,000	00,000		00,000	00	00						
		D/S	00,000	00,000	00,000		00,000								
		Comb	000,000	000,000	00,000	000,000	000,000			0	00	0	000,000	000,000	000,000
	New York	O/S	00,000	00,000	00,000		00,000	00	00						
		D/S	00,000	00,000	00,000		00,000								
		Comb.	000,000	000,000	00,000	000,000	000,000			0	0	0	000,000	000,000	000,000
	Chicago	O/S	00,000	00,000	00,000		000,000	00	00						
		D/S	00,000	00,000	00,000		00,000								
		Comb	000,000	000,000	00,000	000,000	000,000			0	0	0	000,000	000,000	000,000
	Seattle	O/S	00,000	000,000	00,000		000,000	00	00						
		D/S	00,000	0,000	00,000		00,000								
		Comb	000,000	000,000	00,000	000,000	000,000			0	00	0	000,000	000,000	000,000
	Philadelphia	O/S	00,000	00,000	00,000		00,000	00	00						
		D/S	00,000	00,000	00,000		00,000								
		Comb.	000,000	000,000	00,000	000,000	000,000			0	00	0	000,000	000,000	000,000
	Portland	O/S	00,000	000,000	00,000		000,000	00	00						
		D/S	0,000	0,000	000		0,000								
		Comb	000,000	000,000	00,000	000,000	000,000			0	0	0	000,000	000,000	000,000
	Total Branches		000,000	000,000	000,000	000,000	000,000						000,000	000,000	000,000
Subsidiaries	Walworth Int. Co.		000,000	000,000	00,000	000,000	000,000			0	00	0	000,000	000,000	000,000
	Walworth Ohio Co.		000,000	000,000	00,000	000,000	000,000			0	0	0	000,000	000,000	000,000
	Walworth-Munzing.		000,000	000,000	00,000	000,000	000,000			0	00	0	000,000	000,000	000,000
All Units	Grand Total		0,000,000	0,000,000	000,000	0,000,000	0,000,000			0	00		0,000,000	0,000,000	0,000,000

value for estimating which is found in the past accounting records. But, even now, because the month by month and year by year volume variations are so great, we do not feel that estimators are in a position to estimate satisfactorily a period greater than 45 days in advance, as required for the monthly budget now in operation.

The lack of a formal manual is not to indicate that the estimate requirements of each executive are not clearly defined. All estimate schedules, as is the case with those here exhibited (Tables 1-7), do clearly define, in terms familiar to the executives, just what each detail of his estimate is to cover.

On the tenth of the month previous to the month to be estimated (hereafter called the "performance" month) these estimate schedules are sent to every unit which makes sales and therefore collects cash, or which purchases materials or services and therefore disburses cash. The various schedules provide for contribution of estimates covering every activity of the business which involves external income or outgo as well as inter-unit transfers of material and cash. The burden of "estimating probability" is placed upon the men upon the firing line, and the estimate schedules sent them are a part of their useful equipment.

For example, Table 1 provides the necessary questionnaire for recording the estimated sales of one of the merchandising units, and Tables 2 and 3 are for recording estimated cost and expense of that unit. When the schedules are sent to the unit by the planning and statistics section, the accrued "Actual" for some past month is filled in against each item in the "Actual" column. Each cost or expense schedule provides for estimating on each item from two viewpoints: first, from the viewpoint of invoices to be received (or liabilities to be set up) during the month; and second, from the viewpoint of cash to be expended during the month.

It is perhaps well to emphasize again the fact that these schedules are prepared in terms of the accounting facts in the hands of the estimators. For any estimate item, where ordinary wording may lack precision of statement, specific account numbers define the limits of the detail to be included. But, beyond this, Table 1, in its subdivisions, ties in with similar subdivisions on the auditor's sales analysis for that unit. The groups of Table 2 compare with the groupings of the purchase register. And the total, as well as details, of Table 3 are comparable exactly with the total and certain groups of details of the unit's detail expense analysis.

The estimate schedule forms are designed to facilitate use of the operating ratios discoverable from past records. For instance, with reference to the estimated figures to appear on Table 1, the percentage of out-of-stock sales to total may be discovered from the figures in the past "Actual" column. The estimator's own records may yield this ratio, and, in addition, the similarly figured ratio for earlier periods. He may note the constancy of the ratio over all periods or possibly a trend up or down. Consequently, though he may estimate dollar volumes greater or less, the interrelation of the component parts of total can be anticipated with accuracy.

The care in designing the forms for ease in utilizing these operating ratios is extended to the inter-schedule relations also. For instance, item 1 of Table 1 covers

TABLE 5. DETAIL SUMMARY NEW YORK BRANCH
ANALYSIS OF COMMODITY PURCHASES

For Month of July, 1923

	FEB.	MARCH	APRIL	AVERAGE	PER CENT OF SALES Ave.	PER CENT OF SALES Est.	ESTIMATE BY UNIT	REVISED ESTIMATE	COMMENT
Out of Stock Sales									
Owned and consigned pipe	00,000	00,000	00,000	00,000			00,000[1]		
Other O. S.	00,000	00,000	00,000	00,000			00,000[1]		
Total O. S.	00,000	00,000	00,000	00,000			00,000[1]		
Purchase Cost of Sales									
Owned and consigned pipe	00,000	00,000	00,000	00,000	00		00,000[2]		
Other O. S.	00,000	00,000	00,000	00,000	00		00,000[2]		
Total cost O. S.	00,000	00,000	00,000	00,000			00,000[2]		
Purchases for Stock									
Owned and consigned pipe	00,000	00,000	00,000	00,000			00,000[1]		
Other O. V.	00,000	00,000	00,000	00,000			00,000[1]		
Walworth I. C.	00,000	00,000	00,000	00,000			00,000[2]		
Total purchases for stock	00,000	00,000	00,000	00,500			00,000[2]		
Direct Shipment Sales									
From O. V.	00,000	00,000	00,000	00,000			00,000[1]		
From I. C.	00,000	00,000	00,000	00,000			00,000		
Total	00,000	00,000	00,000	00,000			00,000[1]		
Cost of D. S. Sales									
Pipe	0,000	0,000	0,000	0,000			0,000[2]		
Other O. V.	0,000	0,000	0,000	0,000	00	00	0,000[1]		
Walworth I. C.	00,000	00,000	00,000	00,000	00	00	00,000[1]		
Total cost D. S.	00,000	00,000	00,000	00,000	00	00	00,000[2]		
Total Purchases Combined	000,000	000,000	000,000	000,000			000,000		
Total Sales	000,000	000,000	000,000	000,000			000,000		

[1] Unit's Own Estimate.
[2] Inserted by P. and S. Section.

stock sales, except pipe, which commodity is important enough to warrant a separate item. The purchase cost of these stock sales (except pipe) is covered by items 1 and 9 of Table 2. These two purchase cost items on the second schedule indicate the two sources of stock material receipts, namely, from outside vendors and from our own factories, that is, from inter-unit sources. The proportion of purchases from each source is fairly constant, and the gross profit margin, considering each source separately, is subject to but slight variation from month to month. Similarly, the purchase cost of stock sales of pipe (item 2 of Table 2) may be estimated by deducting the usual gross profit margin from the stock pipe sales as estimated in item 2, Table 1.

Of course, in practice, the dollar sales amounts for each item are first estimated upon Table 1. The consequent purchase cost of those sales is then figured, utilizing the usual operating ratios, adjusted as the estimator may please in the light of his present knowledge. However, these consequent cost of sales figures will serve for his purchase estimate figures for Table 2 only if he contemplates maintaining inventory at unchanged levels. Otherwise, the figures which he inserts upon that schedule will reflect his policy to increase or decrease inventory.

The completed estimate in the hands of the planning and statistics section 10 days before the first of the performance month, are then ready for review "to determine advisability." This procedure is but a critical analysis of the partially and fully summarized detail of the estimates of all units:

1. To check up for obvious errors in estimating.
2. To reveal policies contrary to those authorized.

Table 4, for instance, shows a summary of estimated sales, compiled by the section on the twentieth of the month, and immediately reviewed, in turn, by the vice-president in charge of sales, by the president's executive assistant, and by the president himself. The very latest information on sales, shown in the left-hand columns, is sufficient to indicate the current trend. The reviewing executive's knowledge of usual seasonal tendencies is refreshed by ratios in the statistical data columns. The last of these statistical columns takes account of the peculiarities of the several estimators, who may be consistent in always estimating high or low by a usual percentage.

The purpose of the review by the several controlling executives is to derive a more valuable final estimate through consideration of the several opinions as to the future, than could be made by any individual who estimates without the aid of other viewpoints than his own. The local sales manager is presumed, on the whole, to know best. Yet, he may not realize approach-

TABLE 6. TOTAL SUMMARY ANALYSIS OF ESTIMATED PURCHASES FROM OUTSIDE VENDORS

In Even Dollars For Month of July, 1923

	FOR STOCK		DIRECT SHIPMENT		EXTRAORDINARY		DEFERRED CHARGES PAID BY G. O.	ADMINISTRATIVE EXPENSE			TOTAL JULY EST.	ACTUAL FOR MAY	PER CENT INC. OR DEC.
	All But Pipe	Stock Pipe	Pipe	Other	Paid by G. O.	Paid by Branch		Commission	Other Paid by Branch	Other Paid by G. O.			
General office										00,000	00,000	00,000	00
Eastern division			0,000	0,000					0,000		00,000	00,000	00
Boston works	000,000	0,000									000,000	000,000	00
Western division				0,000					0,000		0,000	0,000	0
Kewanee works	000,000	00,000									000,000	000,000	00
Boston branch	00,000	00,000	0,000	00,000	0,000			000	0,000		00,000	00,000	0
New York	00,000	00,000	0,000	0,000			000	000	0,000	0,000	00,000	00,000	0
Chicago	00,000	00,000	0,000	0,000				000	0,000	0,000	00,000	00,000	00
Seattle	00,000	00,000	0,000	0,000			000	000	0,000	0,000	00,000	00,000	0
Philadelphia	00,000	00,000	0,000	0,000				000	0,000	0,000	00,000	00,000	00
Portland	00,000	00,000	..	000			000	000	0,000	0,000	00,000	00,000	00
Total branches	000,000	000,000	00,000	00,000	0,000		000	0,000	00,000	0,000	000,000	000,000	00
Walworth Int. Co	0,000	00,000	00,000	0,000		000			00,000		00,000	00,000	00
Walworth Ohio Co	00,000	00,000	000	000			000	000	0,000	0,000	00,000	00,000	00
Walworth-Munzing	0,000	00,000	00,000	0,000		000			00,000		00,000	00,000	00
Grand Total	000,000	000,000	00,000	00,000	0,000	000	000	0,000	00,000	00,000	000,000	0,000,000	00

ing difficulties in production which will limit the material he may receive for sale. Or he may underrate many favorable signs of better business. Consequently, it is desirable that the review upon this summary schedule should permit the merging of many viewpoints as it does when the president inserts his opinion in the final column.

Review schedules in varied form, though similar in purpose, are prepared for review, by controlling executives, of:

Each works' raw material purchase, in summarized groups (for the vice-president in charge of production and for purchasing agent).

Each merchandising unit's finished goods purchases (for the vice-president in charge of sales).

Each unit's expense and pay-roll commitments (for the vice-president, who is in charge of sales and of production and also for the treasurer).

Each collecting unit's cash receipts (for credit manager).

Each disbursing unit's cash payments (for the treasurer).

Each merchandising unit's net profit (for the president, for the vice-president in charge of sales, and for the treasurer).

"Detail Summary" sheets, which are prepared for single units only and for review by lesser executives, are prepared before, and are subordinate to, "Total Summary" sheets. These "Total Summary" sheets show master totals for all units upon a single page and are reviewed by major officers, as in the case of the sales summary sheet.

To show the form of some of these review schedules, three are presented. Table 5 is a detail summary of the proposed commodity purchases for a branch. Upon the sheet past dollar amounts are given and some of the consequent operating ratios developed. Although the estimator does not estimate the purchase cost of sales, the section figures the dollar cost amounts upon the basis of past cost of sales ratios. When contemplated stock purchases for the month are referred against this figured cost of sales for the month, any excess of purchases indicates the extent of inventory increase, or, contrariwise, the extent of its decrease.

The estimated amounts of this detail schedule, Table 5, are copied over to the proper line of "Total Summary" schedule, Table 6, summarizing the purchase for all units. While this sheet does not give so much past detail, it does give the general purchasing agent a quick summary picture of the net effect of all commitments and a definite pointer to the unit contemplating any undesirable excess.

Table 7 indicates the form adopted for summarizing pay-roll, where adequate impression can be gained only by inserting on the sheet the estimated figures for the current month, which intervenes between the latest "Actual" figures available for comparison and the estimated figures for the coming performance month. It may be of interest to note that we compare current pay-roll with so remote a month as July 1921, because the figures for that month represent our rock bottom of pay-roll during a depression and because, presumably, and if necessary, we could curtail to that extent again.

TABLE 7. TOTAL SUMMARY MONTHLY PAY-ROLL ESTIMATE JULY, 1923

	JULY ESTIMATED	JUNE ESTIMATED	PER CENT INC. OR DEC.	MAY ACTUAL	PER CENT INC. OR DEC.	JULY, 1921 ACTUAL	PER CENT INC. OR DEC.
	(26 Week Days) (25 Working Days)	(26 Week Days) (K W. 26 Working Days) (B W 25 Working Days)		(Audit'd) (27 Week Days) (26 Working Days)		(26 Week Days)	
Total salaries	$000,000	$000,000	0	$000,000	0	$000,000	00
Total wages	000,000	000,000	0	000,000	0	000,000	00
Total salaries and wages	000,000	000,000	0	000,000	0	000,000	00
Boston works							
Office and factory (salaries)	00,000	00,000	0	00,000	0	00,000	00
Managerial salaries	0,000	0,000	0	0,000	0	0,000	00
Wages	000,000	000,000	0	000,000	0	00,000	00
Total	000,000	000,000	0	000,000	0	00,000	00
Kewanee works							
Office (salaries)	00,000	00,000	0	00,000	0	00,000	00
Managerial salaries	0,000	0,000	0	0,000	0	0,000	00
Wages	000,000	000,000	0	000,000	0	00,000	00
Total	000,000	000,000	0	000,000	0	00,000	00
Eastern division (salaries)	0,000	0,000	0	0,000	0	0,000	00
Western division (salaries)	00,000	00,000	0	00,000	0	00,000	0
Total	00,000	00,000	0	00,000	0	00,000	0
Total branches (-50, -52, -56)	00,000	00,000	0	00,000	0	00,000	00
Total branches (-55)	00,000	00,000	0	00,000	0	0,000	00
Total branches (salaries and wages)	00,000	00,000	0	00,000	0	00,000	00
Boston branch (-50, -52, -56)	0,000	0,000	0	0,000	0	6,000	00
Boston branch (-55)	0,000	0,000	0	0,000	0	0,000	00
Boston branch (Total)	00,000	00,000	0	00,000	0	0,000	00
New York branch (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	00
New York branch (-55)	0,000	0,000	0	0,000	0	0,000	00
New York branch (Total)	00,000	00,000	0	00,000	0	0,000	00
Chicago branch (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	00
Chicago branch (-55)	0,000	0,000	0	0,000	0	0,000	00
Chicago branch (Total)	00,000	00,000	0	00,000	0	0,000	00
Seattle branch (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	00
Seattle branch (-55)	0,000	0,000	0	0,000	0	0,000	00
Seattle branch (Total)	0,000	0,000	0	0,000	0	0,000	00
Philadelphia branch (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	0
Philadelphia branch (-55)	0,000	0,000	0	0,000	0	0,000	0
Philadelphia branch (Total)	0,000	0,000	0	0,000	0	0,000	0
Portland branch (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	00
Portland branch (-55)	0,000	0,000	0	0,000	0	0,000	00
Portland branch (Total)	0,000	0,000	0	0,000	0	0,000	00
Walworth Int. Co. (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	0
Walworth Int. Co. (-55)	0,000	0,000	0	0,000	0	000	00
Walworth Int. Co. (Total)	0,000	0,000	0	0,000	0	0,000	0
Walworth Ohio Co. (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	00
Walworth Ohio Co. (-55)	0,000	0,000	0	0,000	0	0,000	00
Walworth Ohio Co. (Total)	0,000	0,000	0	0,000	0	0,000	00
Walworth-Munzing (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	..
Walworth-Munzing (-55)	0,000	0,000	0	0,000	0	000	00
Walworth-Munzing (Total)	0,000	0,000	0	0,000	0	0,000	0
General office (salaries)	00,000	00,000	0	00,000	0	00,000	00

Planning and Statistics Section.
Boston, June 23, 1923.

Visualized Management Control

A System Which Shows Up Exceptions and Slips

By CHESTER B. LORD

> "In the first place, you don't need to bother very much about the things that are going all right, except to try and make them go a little bit better. But you want to spend your time smelling out the things that are going wrong . . . and persuade them to lead a better life."
>
> — *Letters from a Self Made Merchant to His Son*

To know by seeing is easier than to know by any other way. To manage by dealing with exceptions only is easier than to exercise control over every operation.

Upon these two foundation facts Mr. Lord has built a rounded out system of management control with its methods and mechanisms, which can be applied to any kind of varying conditions and factors and in any place.

CONTROL is becoming a dominant need in industry. Engineers have appreciated its necessity for a generation, and now the public, realizing what the continued operation of industry means to its well-being is beginning to demand some form of intelligent direction. Proof of this latter comment is found in the recently issued report on the anthracite coal industry.

With this background, and in the face of this pressing necessity the duty rests upon each one of us to contribute whatever we may of our knowledge of what control means and how it may be secured and maintained.

We have always considered system an end, instead of merely a means or procedure that determines the cost of administration, just as the method of fabrication determines the cost of manufacture. Neither necessarily affects the quality of service or product, which in either case is a matter of insistence, either personal or by unevadable recurrent checks. Any method used, in or by itself, is merely an expression of individual opinion or preference. There are as many systems as there are offices, as many methods of fabrication as there are shops, and each system or method merely says: "I prefer it done thus." Control, on the other hand, says: "It *must* be done thus." The same fundamentals apply to every office, and every shop, and are so employed, diluted it may be, to a degree measured by the successful administration of the concern.

System may be varied to suit conditions or changed to suit conveniences, but the essentials of management control are fundamentals and are not a question of methods. These fundamentals may either be incorporated into or imposed upon any system, or variety of systems, just as we have the option of assimilating the chemicals necessary to our health and growth in a natural way, or taking them by the teaspoonful from a doctor's prescription. The essentials of healthy growth are inherent alike to the human and industrial body.

System is singular, control is plural, and is a series of fundamental units, capable of combination, and separation into any desired group or combination, without weakening any unit. This is self evident if they be as claimed, fundamentals applicable to any phase of industry.

Management has developed because of three factors. First, because of the dilution of the quality of executive material available, due to too rapid expansion. Second, because we believe, or have been led to believe, that efficiency is more dependent upon systematization than it really is, and third, because directive management demands anticipative analysis, and visualization, neither of which has been possible under present conditions. The penalty paid for this development has been unnecessary overhead, the throttling of initiative, and the averaging of ability.

The control necessary varies obviously with the size of an industry, nature of its product, and the enterprise of its management. But even a single control unit, properly applied, necessitates the better observance of the systems contributing to it, or the substitution of more practical ones.

Let us turn now from the system, which is static, to men, who are dynamic. Throughout history the exceptional men have been those unhampered by rules and restrictions, or big enough to disregard them at times when it seemed necessary. Cutting themselves off from communication has always been a measure adopted to prevent interference. This act has always been applauded for the reason that only men of initiative resort to it. This has been true also in industry, science, engineering, and exploration. In case of trouble, lack of initiative suggests trying something else, substituting instead of curing; here the weak resort to expedients and the strong force results. Initiative says, we'll "fight it out on this line if it takes all summer." The one results in system, the other in control.

There is a psychological reason for this intolerance of system in that the will of man is essentially free and creative and the strong creative impulse is opposed to repetition or slavish system

The creative impulse is a natural law and it is wiser and cheaper to utilize a natural law than to oppose it. This applies in management, as elsewhere. It is a fundamental of management to hold a head of department responsible for results leaving to him the methods, and as well banish fire because it destroys as to throttle initiative because it errs.

An efficient executive is a wholesaler; a systematic man is a retailer. Each is efficient in his particular field, but in effective management we deal with wholesalers; and while in the nature of things they will not be as efficient in details as some of their staff, industry must have initiative to accomplish big things, as well as system to save small things. The wholesaler and retailer, initiative and system, properly co-ordinated supplement one the other.

Taylor never intended that his ideas should evolve into an autocratic, system-bound method of management. This is proved by the simplicity of his fundamentals, and the fact that he specified the exceptional principle as one of the essentials of management. That principle is the antipodes of autocratic system, and just why this essential has received so little recognition, it will be the purpose of this article to set forth.

History, the example of successful men, and natural inclination, all point to the conclusion that the exceptional principle is the natural method of management, as opposed to the present or corrective method. Possibly the fact that it is natural accounts in part for the paucity of information concerning it. Taylor laid it down as one of the essentials of scientific management, but did not elaborate upon it so far as we can find. Gilbreth mentions it in connection with graphics, and states that "some men use the exceptional principle in management unconsciously," and one is led to wonder why it has not been advocated and "passed through" technical literature, along with the other principles of Taylor and of Gantt who was emphatic in its advocacy.

One engineer gave it as his opinion that being natural it was no more capable of definition and method application than is ability or initiative. The answer to that, however, is that we find means of utilizing and controlling both ability and initiative, and I shall attempt to set forth the means of utilizing, directing and extending the exceptional principle in management, claiming nothing original except what a patent application terms "a new and useful combination." The conclusions arrived at are the results of the writer's studies and experience, most of which are undoubtedly common knowledge and experience.

From the background of the discussion of these two factors in control, of static system and dynamic men, we are ready to consider the form which has had actual use for a period of some three years under widely differing conditions. To simplify the presentation of the principles upon which it is founded it is wise to give the definition and explanation of a few of the terms which must be used.

Control is management based on unevadable recurrent checks, closely enough together for safety, distant enough apart for flexibility.

Simplification is a phase of management reduced to a few simple rules and given a common denominator.

Visualization is the presentation of any number of related facts in proper perspective, selectively emphasized, and with a common denominator.

FIG. 1 A CHART ROOM FOR VISUALIZED MANAGEMENT CONTROL

Fabrication is any form of mechanical work; it is the departmental common denominator.

Repetitive fabrication is fabrication in recurring lots, and upon a scale that demands the *conservation of time at the expense of material.* It is the simplest form of production.

Intermittent fabrication is fabrication in small lots or on individual sales orders with or without special features, with or without adequate tools, and where *material is conserved at the expense of time.* (Repetitive and intermittent fabrication are the two extremes, and constitute the only difference between the large and small shop.)

Co-operation is the perfect performance of *one's own part* of a given task.

Co-ordination is a common service for all without authority or criticism. (The common conception of co-ordination is arbitration).

It may seem from the definitions given that some of the elements of control to which they apply are difficult of realization. However, from them comes in concrete form our concept of the exceptional principle in management, for which there seems to be six major arguments.

1. The exceptional or budgetary control principle in management is obvious, natural, and necessary. It is always used, consciously or unconsciously so far as possible and beyond that point is supplemented by system.

2. Successful management is based upon forecasts which the exceptional method demands, and not upon reports which system furnishes.
3. Gilbreth states: "It makes better executives" and yet permits the use of less efficient ones for it selectively "apportions the load to the back." It cumulates instead of averages ability, and the effectiveness of the efficient supplements the efforts of the less efficient instead of being hampered by them.
4. Inasmuch as exceptional management demands the attention of the executive only for conditions predetermined by himself, he is allowed time to "look and reason" and for constructive planning. His measure of ability is shown in results, the ability of the executive is evaluated in the same terms and at the same time as that of his subordinates. Further, a definite "measure of management" is provided by showing and differentiating the relative and actual efficiency of individual or department.
5. Exceptional management demands the budgetizing of 100 per cent of all items, but this operation is needed only once, not continuously as in ordinary planning. For this reason many schedules, graphs, and much correspondence are made unnecessary.

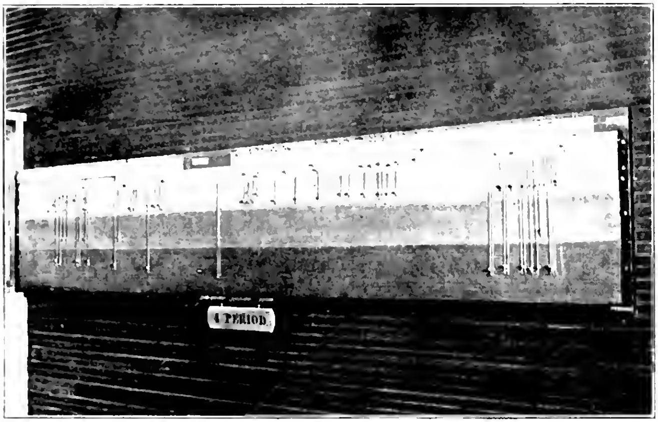


FIG. 2 A VISUALIZED MANAGEMENT CONTROL BOARD

6. Exceptional management enforces co-operation in the sense defined and allows co-ordination without gaps, laps, or arbitration.

With all the advantages above outlined and the significant absence of objections, the question naturally arises: "Why is this method not being used?" Why did Taylor not outline it as a definite form of management, rather than a principle? Why did not Gantt carry its application farther when he so emphatically endorsed it? And why do not industrial engineers use its application if it be as outlined?

In management less than elsewhere do we secure something for nothing, and the price for exceptional management is anticipative visualization; herein defined as "The presentation of any number of related facts in proper perspective, selectively emphasized and *with a common denominator*." Gantt knew the price and said at the meeting at which he explained his charts:

> For years with lack of efficiency at the top staring me in the face, and hampering me at every turn, I have labored to find a means of measuring that efficiency . . . If we can measure and evaluate the productive efficiency of the manager as we now measure that of the workmen, we may hope for better results. . . . I offer as part of the work of measuring executive efficiency, the chart shown in my paper.

The Gantt type chart is described by Wallace Clark as: "the greatest contribution to industry in a decade," which again emphasizes the importance of visualization. Gantt achieved three things with his charts. First and greatest, simplification, the substitution of a straight line for an erratic one; second, a basis of comparison in terms of time or quantity; and third, through these two together a static visuality that has increased man's ability to govern. It is difficult to see how they can be improved upon as static records, and compared to most others they are a two dimension chart as opposed to a single dimension. But exceptional management demands emphasis, selectivity, and a denominator common to every factor and condition met with in industry, and obviously, it must be universal and kinetic. It is clear that any such chart or control mechanism would not conflict with the usefulness of the Gantt or any other static graph.

Exceptional management is interested only in exceptions. It desires and keeps no records beyond its master sheets, allowing results to speak for themselves. Therefore, any application of the chart or mechanism used is of no use for record or post mortem comparison, even were it not kinetic.

G. Charter Harrison says:

> No executive should be furnished a chart or report that requires interpretation, nor should he be compelled to study them as a routine in order to secure vital information.
>
> Executives who endeavor to make use of the information prepared for them . . . are engaged in a constant struggle to extract the essential facts necessary for their guidance in the operation of their business. . . . Reports to executives should be based on the principle of exceptions.

The first essential of management is simplification, and in this one requirement we find the answer to our query as to why the disciples of Taylor have not followed the requirements of scientific management as he laid them down. Our definition gives us a clear idea of what simplification means. We can and are simplifying mechanical processes because we have a record of the several steps that give the proper perspective, and a basis of comparison, as well as the finished apparatus or tool as a permanent record.

We are simplifying clerical method for we have the same means of doing so; but we cannot, or have not, to any extent, simplified production control. We have systematized and oversystematized it, but we have not simplified or "controlled" it under the corrective method of management.

The reason for this brings us back to our second and greatest requirement, visualization. Anything that can be visualized can be controlled or codified and simplified, whether it be the solar theory, the germ theory, or the theory of production control. Visualization destroys theory, and the greatest lesson that it teaches is that there are no small things; that everything is finite and has a definite influence, and that the difference between failure and real success is a matter of a few per cent. Visualization not only promotes, but demands accuracy and the measure of one's capacity is his ability to visualize. There are no more, nor any more important decisions to be made in a plant of 5000 men than in one of 1000, but more factors are involved, and the difficulty of visualization is increased.

To offer another definition to clarify our discussion, visualized management is the exceptional principle visualized. In its operation results are held paramount to methods used in securing them, responsibility is selective and each factor receives attention in proportion to its need, leaving the executive free to "look and reason." In visualized management we begin to realize what Ralph Waldo Emerson had in mind when he said:

> The memory disburdens itself of its cumbersome catalog of parts, and combines a century of observation in a single formula.

Executive ability best shows itself in the rendering of intelligent decisions, based upon correctly evaluated information furnished by others. The only means of securing correctly evaluated information is to have the means of visualizing in an anticipative manner, 100 per cent of factors 100 per cent of the time. Any form of successful management demands this; visualized management cannot be used without it, for while it concerns itself with only those items that require attention, it *notes the condition of all items at all times*, and with selective emphasis and responsibility. Every item is at all times under the scrutiny of someone; and, before it reaches trouble, the proper authority has taken all steps in his power to correct it. If correction is beyond him it passes to his superior. The shepherd herds only those sheep that stray, but he does not wait for the wolves to get them before he interferes, and because he does not herd them all, he has time effectively to herd the strays, and it is the strays, the exceptions, of industry that bother, not the great body of operations. Visualized management loads no one beyond his capacity. When he has reached that limit, the load is automatically shifted, and we do not find a subordinate chasing the important exception, which perhaps he can do but indifferently, and neglecting the many which he can do efficiently.

But we must have visualization that is simple, effective, and with a common denominator. The common denominator is, perhaps, a matter of simplification rather than visualization, if we recognize our definitions given at the beginning, but simplification is simply impossible without the other. In fact visualization forces simplification and is the vital element in any form of management. Our task is to drive that fact home to those who realize that this is so, and admit it; to those who do not realize it; and to those who do not admit it.

Visualization is a much overworked word, like efficiency, and system; but not only in management but everywhere in industry we are seeking methods of seeing the intangible and hidden, and when we once have achieved that end, we go on subdividing, combining, and co-ordinating factors to give differential visualization. We are no longer content to know that gases escape up the stack; we want to visualize them. We are no longer satisfied with a theoretical millionth of an inch. We demand a visual instrumental measurement. We are no longer content to watch a multiplicity of different electrical instruments. We demand their combination and integration into a single visualization with a common denominator. Seeing is knowing. Seeing gives a basis of comparison without which we cannot reason. Some psychologists hold that if we were without the senses of taste, hearing, feeling, smell and sight, we would lack the ability to think, because mental processes are merely reactions to external action, and of these, the chief are registered through sight.

Rules of Visualized Management

In practice the rules of visualized management have been reduced to six, as follows:

1. In repetitive fabrication the purchase, fabrication, and delivery of material is based upon the actual product finished.
2. Time, being the basis of manufacture, all other factors, to be intelligible and comparable, must be presented in their relation to time.
3. Accuracy demands the visualization of 100 per cent of all factors, 100 per cent of the time.
4. Any chart or graph which presents results demanded from or achieved by any department shall not be posted by the department concerned.
5. Any check to be effective must be obligatory, recurrent, and unevadable.
6. Consistency of procedure must never interfere with an obvious exception to that procedure or its system.

This form of visualized management control and its six practical rules cover so far as I can see, the whole of industry. Both rules and controls are simple and are based on definitely stated underlying principles. Furthermore, the entire plan has had the practical test of a considerable length of time, and under widely different factory conditions.

A following article will show some of these applications and will explain in detail the "Tell-Tale" which is a device developed to visualize requirements, whether they be for purchases of materials, for sales orders, for materials and stores, for fabrication, for distribution of expense charges and burden, or for any other purpose in any place where there are varying conditions.

The Province of the Controller

III—Preparing Formal Plans and Holding to Them

By JOHN B. GUERNSEY

Controller, the Emporium, San Francisco

A FEW years ago Henry Ford was severely criticized, ridiculed, and maligned for a somewhat cynical reference to the practical value of history. Most of us joined in the denunciation. A good many business men have since come to see that what Mr. Ford had in mind, and probably said originally, was that in business the past is dead. Its effect is already indelibly impressed upon the business, and the preparation and reading of elaborate reports cannot be classed among the useful occupations. The preceding article said: "The only thing of any value in last week's history is the *corrective* effect or the confirmation or the directing effect *on your own plans for next week* and the weeks after."

If you have no plans for next week or the weeks after you can neither confirm them nor change their direction. If you are drifting with the current, a daily or hourly bulletin of your progress may be interesting but it is hardly of value. But if you are making a definite point at a definite time, the same bulletins that before were merely interesting now become of value, and may cause you to change your direction or increase your speed or merely hold your course. If your objective is 100 and your reports show that the point 40 is reached you can determine thereby that you have 60 to go. But if your objective is an unknown or whimsical quantity, the fact that point 40 is reached gives you no measure of the distance yet to go and therefore it can have no effect upon your plans.

In every business enterprise except the small one-personality concern there is required "an official of executive status, familiar with accounting and economics, not charged with the preparation of accounting reports but using them in connection with his work of furnishing the chief executive with vital current facts necessary to control the speed and direction of every department of the business." This is Mr. Guernsey's characterization of the controller as a force in modern business.

The reason the usual accounting report is of no practical value to the average business concern, and that "in a great many businesses the chief accountant and the entire accounting organization might as well be scrapped, as far as their value to the business is concerned," is that the reports are not acted upon. The accounting organization may have done its full duty. It may have accurately presented facts that mean that point 40 is reached, but the management does not carry on. The management does not interpret the report as meaning that because point 40 is reached it has 60 to go and therefore must *act*. It does not even know that the point reached is point 40. The management has not yet added to its other duties that of interpreting accounting reports and statistical data in terms of action.

An everyday blue-tipped match may be presented to each of two executives. One may use it to light his pipe and enjoy a satisfying smoke. The other may use his to light the fire under a reserve boiler and give the plant just the few horsepower of additional energy necessary to boost it over a peak and keep up to schedule. The two matches were not different. They cost the same, looked alike, had the same limited potentiality. Of itself, the match that was used to keep the plant up to its schedule produced no greater heat or flame than the other. It was simply used differently.

The two matches may be compared to two similar accounting reports in the hands of two dissimilar executives. The one finds in his much of interest and it passes into oblivion. The other finds in his much that results in action, and the report itself passes into oblivion as did the other, but in its moment of life it started something. With plans to meet, an accounting report can show whether they have been met to date, but even that does not result in action. The practical action comes only when the business, comparing the report's known performance with a predetermined schedule, learns that it is off the schedule, knows to what extent it is off and how to get back, and then does something about it.

Supply of Business Geniuses Limited

Now there may be thoughtful readers who at this stage will call to mind one or more successful executives of their acquaintance who do get something of value from their financial reports without the aid of blueprints and compasses, and they may begin to doubt. Let us get clearly in mind, therefore, that such men are not exceptions to the rule that definite plans are a necessity, but are simply exceptional executives who are able to formulate their plans in their minds and whose experience enables them to interpret their reports in terms of those plans. Their intuition and judgment are the outward evidence of a subconscious reaction which they do not analyze and of which they are not altogether aware. They are regarded as business geniuses. You say of them that they can eat up a report. But such men always act after they have eaten. Do not let us fool ourselves into the belief that they operate without plans—that they are superior to schedules of performance. As they read a report they are looking for certain facts and they have in mind a definite measure of what each fact should be. If what they find does not agree with what they expect to find, they know they are off schedule as to that item. Where the report and the preconceived standard agree, those points are of no further interest. By a process of elimination they boil a report down to two or three or a half-dozen points that thereupon enjoy their exclusive attention and action.

Among the smaller business concerns there are found many executives who can thus operate without formal plans or budgets (using that word in its broadest sense) but they are not operating without plans. Their familiarity with the business in its every detail and the limited physical scope of its operations enable them to visualize its progress from day to day. They usually have discovered an incipient or actual deviation from their plans and have acted to correct it long before the formal reports come out. The reports serve merely as confirmations, like the confirming copy of a telegram that is received by mail long after the original has been acted upon.

As a business grows more complicated or covers more area the executive gradually loses the ability to visualize it by personal daily contact. Then reports and figures themselves become a necessity and a prime factor whereas before they were merely confirmatory. With continued growth the business soon reaches the point where figures must be relied upon for the great majority of the essential facts upon which the executive bases his course of action. In time the mental standards against which the figures are compared likewise become hazy because there is a limit to the number of facts which any mind can retain profitably. When that stage is reached the executive who is big enough to grow with his business turns definitely to the substitute of formal plans or budgets.

Feeling the Pulse

The preparation of formal plans requires an enormous amount of research, the marshaling of innumerable facts and the preparation of a schedule or time-table in great detail. This takes much time and a high order of ability, and must be done by the chief executive or some one of executive caliber. Throughout the period covered by the plans there must be constant comparison of accomplishment with plans, recognition of any deviating tendencies at their first appearance, modifications and enlargements of the plans to meet changed conditions and the direction of extra energy to threatened spots just as the railroad division superintendent directs extra motive power to points along his division where he anticipates or is having trouble in maintaining the schedules. To take over this work there is required an official of executive status, familiar with accounting and economics, not charged with the preparation of accounting reports but using them in connection with his work of furnishing the chief executive with vital current facts necessary to control the speed and direction of every department of the business. That official is the controller.

The controller is not the chief accountant, although the accounting department falls under his executive direction. His critical interest in the accounting department arises from the fact that the accuracy of his decisions depends directly upon the accuracy of the details of his accounting reports. Where a corporation has a controller it will be found to have an efficient accounting department, for the controller knows how easily figures can mislead. In an earlier article of this series it was shown why the controller, although he is not the credit manager, is nevertheless in charge of the credit department. Likewise the controller, although he is not the treasurer, is in charge of many of the fiscal activities of the business through the necessity of dovetailing the financial plans with all of the operating plans or budgets and maintaining the balance throughout the operating period. Further, the controller is not the corporation's attorney but upon him rests the responsibility for seeing to it that the organization conforms to the innumerable municipal, state, and federal laws, including the tax laws.

Use of Economic Statistics

Just as an accounting report is a waste of money if there are no plans against which to compare its showing, so are detailed plans a waste of effort if there is no machinery for the detection of deviations from those plans in time to do something about it.

It is told of the controller of a well-known New York corporation that he nearly lost the confidence of one of his influential directors at one time, due to his keen interest in the stock market. This controller's office walls are lined with charts, and those which immediately attracted the attention of the director upon the occasion of a casual visit were devoted to the price trends of stocks, several sets of index numbers, wheat and metal statistics, mail-order sales and car-loadings. Now it happened that the company did not use wheat or pig iron, did not sell to the mail-order houses, and the director frowned upon any form of stock speculation on the part of men in positions of great trust in any of his companies. Nothing was said at the time, but weeks afterward the matter was broached in a directors' meeting after the controller had left the room.

The controller's value to his company was unquestioned, he was liked personally by the several directors and they knew that he was aware of the feeling against speculating by executives. So they promptly called him back and asked for an explanation. That meeting lasted for another hour. It was adjourned to the controller's office where almost half of the trend charts were explained in detail, to the intense interest of every man present. By the time the meeting broke up the directors were informed for the first time of the machinery behind the scenes, the various sources from which the controller obtained reliable and significant data on which he based his forecasts of major trends and because of which he was able to recommend enlargements or restrictions of plans with remarkable accuracy. Incidentally their confidence in the controller was increased correspondingly.

Trends

The trend factors which this controller uses are employed by many other controllers for the same purpose of checking plans with major economic movements. It helps to think of them as comparable to the range finder and distance charts by means of which a coast defense rifle is able to register a clean hit on a target far out of sight at sea. He uses the price movements of a selected list of industrials and rails because they disclose in their general movements what investors think of the business outlook—investors who employ expensive organizations to keep themselves accurately informed and who back their judgment with their money. As a rule the market has anticipated and discounted every major move before the general public is aware that a change is in sight.

The visible supply of wheat and other cereals, the cotton situation and the price of farm-products to the consumer and at the farmer's gate all show what to expect a few months hence in respect to the situation of the railroads, the middlemen industries, and the retailers as well as the great mass of people who are producers of foodstuffs or directly dependent upon such producers. Metal statistics, particularly pig iron production and the Pittsburgh price of foundry and basic, and the corporation's unfilled orders all have their significance to the man charged with the duty of making plans that can be attained and that yet represent all that can be attained. Even the railroads' orders for rails and rolling stock are significant, for many roads can be depended upon to buy most heavily just before prices retire to the storm cellar. Of course all of these factors are also watched by Wall Street and are reflected in stock prices, but it is evident that they have additional elements of prognostication, to the controller concerned with a particular industry, that cannot be detected in the stock quotations alone.

On the other hand there are other factors which must be watched not so much for their direct significance as for their value in testing conclusions drawn from other sources: for instance, mail-order sales, car loadings, tonnage clearing through the Panama Canal and the several sets of index numbers.

Research

Obtaining our general direction and approximate location by such excursions as above in the field of applied economics, let us now restrict our field to that of the particular industry and the particular business enterprise with which the controller is directly concerned.

Research within the industry may be conducted individually by correspondence or through the exchange of information between a group of similar concerns in different cities or more formally through membership in a research association devoted exclusively to that function. In the case of the latter the association will concern itself with a variety of subjects of which many are of no direct interest to the controller. But he is directly concerned with the exchange of uniformly compiled statistics of sales, expenses, personnel necessary to operate certain departments, systems and methods that result in lowering costs of production or operating expenses, with expense per cent, net profit per cent and similar data.

It is essential that all concerns exchanging figures use the same accounting system, particularly as to the content of all accounts, and some standard basis of distributing and pro-rating expenses. Exchanges must be in great detail or at least be based upon detailed compilations which may be obtained upon request when items of particular interest are discovered in comparing some other concern's results with your own. Therefore it is necessary for the controllers who exchange such data to get together frequently and prepare a detailed manual of accounting practice which all must follow.

That is research within the *industry*. Throughout his work the controller endeavors to build up sources of information applicable directly to his particular industry which can parallel his economic statistics. Limiting the field still more, he conducts research within his own *organization*. Some departments of the business are always making a better showing than other similar departments, and certain department heads are able to live up to their planned schedules and within their expense budgets while others are proverbially "in the red." So the controller is studying his own company's detailed operations constantly, endeavoring to build up the weak departments by an exchange of experience with those better managed.

The formal planning or budgeting upon which the modern organization depends is the result of the work of many minds and is directed by the controller. Turning again to the railroad for a simile, it is based upon desired arrival at a certain place at a certain time, but in its preparation it takes the form of a detailed timetable. If the "Century" were started out of New York knowing only that it had to reach Chicago in 20 hours its prospect of doing so would be a poor hazard. Yet how many businesses there are that are operated with as definite means of reaching a desired goal! The "Century" reaches Chicago in 20 hours, day in and day out, only because every mile of its prospective journey is scheduled in detail and its progress throughout the run is constantly compared with the schedule.

Observe, too, that the comparisons are followed by action. Of what value would be the costly timetables by which the engineers keep themselves posted if, when the train has been delayed somewhere along the line they conclude: "Oh, isn't it too bad, we are five minutes behind our schedule at Schenectady!" To them the fact that they are five minutes behind is not a conclusion but merely an observation. Observing by a comparison between schedule and performance that they are five minutes behind, their *conclusion* is that they must make it up by extra speed, and they act. It is only because they *act* at the right times and to the right degree that the train finally rolls into Chicago on schedule.

Budgeting begins with the desire of the management, interpreting the general policies laid down by the directors, to attain a desired result within the approaching year or other budget period. This desire may be expressed in terms of sales volume, enlarged activities or entry into new fields, the attainment of certain main objectives and the realization of a certain net profit. It is then the duty of the executive heads of the production, sales, and financial departments to show how in their respective fields the goal can be attained, and it is the duty of the controller to bring all of these plans together into a connected working whole.

Reconciling the Departmental Budgets

The reconciliation is usually more involved than it sounds and is the result of a process of arbitration, compromise, and reciprocity through long hours of study by the major executives. Finally a workable plan is agreed upon which will attain the desired goal if carried out. It is then incumbent upon each executive head to work out within his particular departments the details of his part of the plan. With these details the controller is not vitally concerned except to insure that in substance they are really workable and are based upon facts and not merely upon hopes. His interest in even this much of the departmental plans is due only to the fact that later he will be seriously handicapped in trying to maintain the whole schedule if it develops that some material part of the plans is unattainable.

From this point onward in the process of budgeting the controller is concerned principally with totals. For instance, in retailing he does not participate in the preparation of the detailed departmental planned sales, reductions, maintained mark-up and expense percentages beyond providing the merchandise manager with the statistics of last year's performance. He is not concerned with the preparation of the sales manager's plans for sales events, sales promotion, advertising campaigns, and departmental allotments, but only with the totals weekly and monthly throughout the budget period. Later he is vitally concerned with the details, of course, not as a part of the budgeting operation but in holding the organization to the schedule after it gets under way.

Holding to the Budget Plan

As soon as the controller is furnished with the detailed plans of each department and has worked out his financial plans to meet the budget of income and expenditures, and the management has given the whole work the final stamp of approval, the organization is ready to launch itself into the future with every probability of reaching its destination on schedule and in good condition. Like the limited train it is provided with a means of calculating its exact position throughout the run. If it is falling behind at any point it has the means of discovering that fact in time to exert extra effort, and so correct the cause. It does not have to wait to see the clock in Chicago to know whether it is going to make it or not.

The detailed budgets give the organization a means of measuring its progress currently, but do not provide any remedy when deviations are discovered. This leads us to consideration of the final step in the control of large-scale operations—the holding to plans, which is part of the function of the controller.

Here is seen the significance of much that has gone before, particularly the controller's dependence upon the accuracy of his accounting department's figures and his use of the detailed departmental plans prepared by the other executives upon which the larger working plan was based. With these before him he is constantly on the alert for deviations and must examine each such to determine whether it is incidental or significant. If it is significant it must be called to the attention of the proper executive immediately and steps taken to correct it. Without this follow-up, no real budgetary control is possible.

If the deviation is of sufficient importance to affect other departments and jeopardize the schedule, it is brought to the attention of the general manager and a group conference is called to consider its effect and its remedy. No one operating executive other than the controller is in position to perform this work, for each is concerned primarily with some one main facet of the whole stone and can see only the significance of the flaws within his own vision. The controller discovers and points out the trouble and leaves it to the other executives to correct. His authority is the general manager's O K on the official budget. He keeps the general manager posted but does not carry his troubles to the Big Chief for action unless he is unable to agree with some other executive on the necessary corrective measures or unless the problem concerns several departments. In the latter event, a conference will be called.

The Controller Here to Stay

Nowadays figures and plans must be depended upon in the effective management of business. The need for them has brought about the need for the controller. He is here to stay because a concern really profits so much by studying itself in action that with no better personnel and no better plant and equipment than its competitors it forges ahead. It is like the man who knows what speed he can hold in a race and runs confidently, in competition with the man who must run from scratch at top speed without any idea how long he can hold out or how far he can go before his strength fails.

If this controllership idea had never been started, there might have been a lot of money saved on executive pay-rolls and less of a shortage of agricultural workers today. Somebody started it, though, and prospered. Soon his competitors discovered that he had something on them and, analyzing his methods and his organization, uncovered the controller and his plans. That being the only tangible difference between themselves and the more successful competitor they promptly adopted plans and a controller to operate them, and found that it worked. Possibly something like that explains how it all started. Or perhaps someone really thought it out.

The Progress Chart and the Bonus Method

By B. A. FRANKLIN

Vice President, Strathmore Paper Company

Class Number
658.532 Progress Records
658.31225 Bonus Systems

No other question has brought from management engineering a greater number of plans and schemes than has the problem of how to get the highest quality and quantity production per worker per working day. None is of greater interest and concern to management itself, and indeed to labor, if it would but realize it. For the most simple economies and experience teach that it is easier to reach a high standard of living when the dollar is of high value in what it will buy, than it is to obtain in wages over any long period, with the dollar at low purchasing value, a sufficiently increased number of dollars.

TABLE 1. PROGRESS RECORD IN CLERICAL LABOR

Clerk No.	Oct. 1, 1920	After 15 Weeks	First 17 Weeks of 1923
1	85.0	97.6	111.6
2	78.6	96.4	103.0
3	90.0	96.0	104.0
4	77.5	94.1	90.1
5	82.4	93.7	99.5
6	77.5	92.3	87.3
7	75.0	88.5	..
8	61.2	84.5	84.3
9	43.7	83.2	87.0
10	37.5	81.2	..
11	35.6	80.0	65.8
12	12.5	77.6	94.2
13	72.5	76.7	88.0
14	42.5	74.8	....
15	10.0	66.6	..
16	18.8	62.2	....
17	..	....	92.1
18	..	....	88.6
19	..	....	87.5
20	..	....	85.3
Average	56.3	83.8	90.5

Since the element of labor is said to account for about 80 per cent of the cost of finished articles, it must be apparent what great possibilities there are of appreciable cost reductions if the proportion of this labor element could be materially reduced. There is no question of the constant possibilities of production increase and labor cost reduction measured in standard terms when labor and management work with confidence together, as is well shown by occasional examples. There are too many cases, as in the building industry for example, where a lack of this confidence has produced quite the opposite tremendously expensive result.

Naturally the best answer to a demand for increased production per time unit, and one steadily being realized, is machinery. But under present conditions, if not for all time, the question of labor and its ability and willingness are involved, and so the question becomes one of human nature.

Now when there is involved a question of human nature an analysis of its ordinary traits must be considered. What is there in average human nature that will make workers continually desire to do their best within reasonable physical and mental limits? Of course men can be driven, and this is the age-old process, now largely discarded. But men who work for wages will put forth the maximum steady effort, and indeed an occasional extraordinary effort, for an added reward. This trait is the basis of all piece-work, premium, and bonus systems. On occasion with certain conditions and under certain leadership men will attain maximum results for the pride of workmanship and the satisfaction of attainment.

Management is essentially interested in discovering which of these conditions or what combination of these

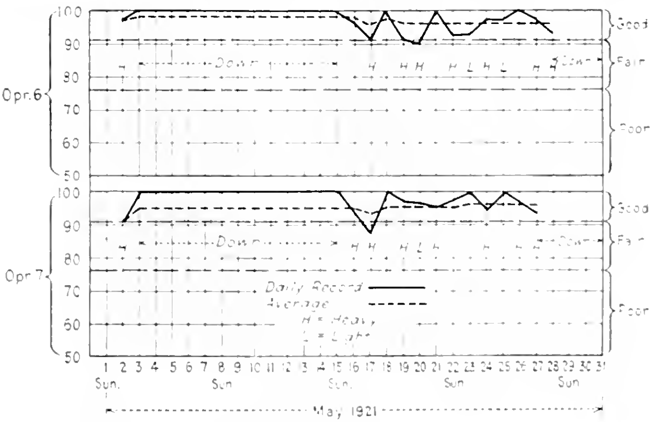


Fig. 1 Progress Record—Loading of Thrashers

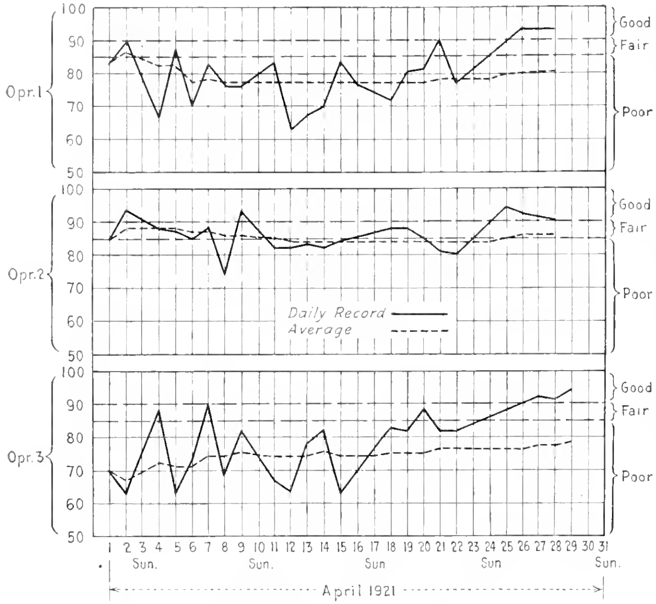


FIG. 2 PROGRESS RECORD—SORTING OF RAGS

will get the best and most continuous results. It ought to be admitted at the start, however, that while there may be one best way, a combination of enthusiasm for any particular mode and an agreement between the workers and management will make any scheme operatively successful, for agreement is the fundamental basis. It ought to be admitted also that the class and kind of work may lend itself more readily to one plan than to another.

One thing, however, is essential in all plans or schemes looking toward improvement in either quality or quantity. That, of course, is the standardization of the task, both as to the detailed method of its performance and the standard amount to be performed in quality and quantity. Men must have definite goals set them, at which to aim, and the way to the goal must be cleared for them as much as possible. It is both foolish and unfair to expect the best of them unless they are offered the best conditions.

All this is to say, really, what of course has been many times emphasized, that the continual successful accomplishments of results in any operation involves a responsibility of management preliminary to and greater than that of the worker. Assuming that management has done its part, how can the worker best be appealed to for continuously satisfactory results in performing his standard-set part?

The results of some experiments continued over a considerable period of time are indicated in the Tables 1, 2 and 3, and Figs. 1-8 shown herewith. Some of the charts show results that have been obtained solely through the operation of the progress chart, and the appeal to the sense of pride in workmanship. Some show what has been attained by the use of a bonus system. And others show results from a combination of the two. These records have been selected from a great many as average records.

Table 1 shows a very good example of what may be thought to be one of the best fields of operation for progress records—clerical work. In clerical work we have a class of workers of above average intelligence. Their reward, at least by precedent, comes in the form of increases of weekly salary and of promotion to higher positions. These workers, it may fairly be presumed, are exceptionally keen to improve their records.

In order to operate such a record it is first necessary to study the clerical work by a time note system, and make out a schedule of what each worker should accomplish daily, weekly, and monthly. This study and scheduling of clerical labor is in itself a valuable effort, and will be found productive not only of

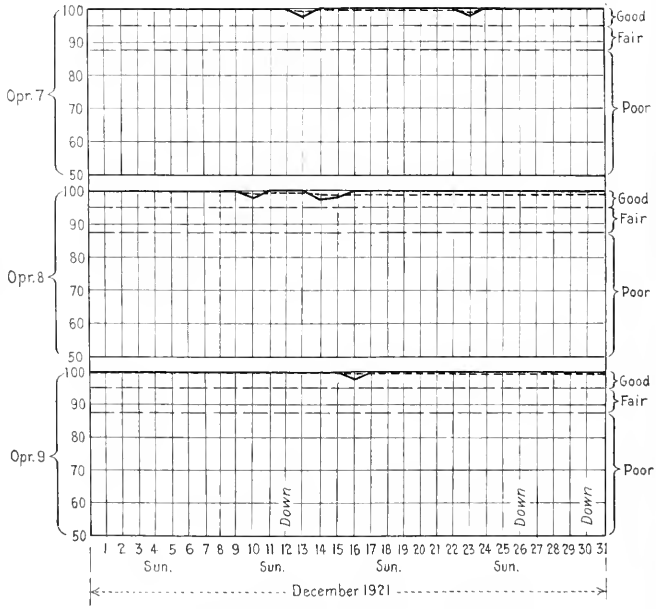


FIG. 3 PROGRESS RECORD—DUMPING OF BEATERS

FIG. 4 AVERAGE POUNDS PER MAN HOUR, WEEKLY RECORD—TRUCKING DEPARTMENT

prompt and regular results, but of a definitely increased amount of work. The record shown in Table 1 tells its own story of results and no chart is needed. The method is made clear following the actual record. (Table 2) This method devised by the head of one department, operates well under the heads of different departments.

The records given in Table 3 show values obtained from the use of progress charts only, except in rag sorting, on certain operations. The figures obtained are charted and posted regularly, daily, weekly, and monthly, or by runs as circumstances require, or judgment demands—preferably, always in such close periods as can be grasped by the operator—and will not average different runs or periods where the work might be expected to vary. In practically all cases a percentage chart is posted as being, once understood, more clearly and quickly grasped.

It will be observed that in some cases there was definite improvement over a long period, and in some cases very little improvement. There [illegible] lapses and a case or so where [illegible] made. In practically all of these [illegible] might have been used. In the rag sorting [illegible] with overlooking or inspection was [illegible].

Here are cases in all of which the operations, so far as the progress record is concerned, are matters of quality, and where the natural desire of human nature, especially where competition is involved, is both to attain reasonable perfection and to make as good or a better record than others whose records are displayed. In such cases, especially where the element considered is not necessarily the major element in the operation, as for example an element of particular detail of quality, where quantity or time are major elements, the progress record, when publicly displayed, and where it is the basis of regular discussion between operator and executive, unquestionably offers a means of definite improvement, and is an upholder of a high level of attainment.

Figs. 4 and 5 are interesting to show the possibilities of the bonus system operated with the aid of the progress chart; Fig. 4 showing the weekly results on which the bonus is paid, and Fig. 5 showing the daily charting which probably need not be a continuous operation except when conditions are difficult.

These charts and the bonus method are interesting, however, in addition, in illustrating what may be done with a miscellaneous gang unloading cars of coal, miscellaneous material, putting it in storehouses, transporting from storehouses to different mills, carrying material from mill to mill, and carting finished material to depot, in addition to doing odd jobs about a village.

Here the essential feature was to find by actual record some unit of weight handled per hour by a gang consisting of a foreman and seven or eight men—varying in number on occasion according to the income of material—and a couple of teams, and doing a considerable variety of work. The result, except as it was held up by very severe winter conditions, in which case the standard might be varied, has proved very satisfactory.

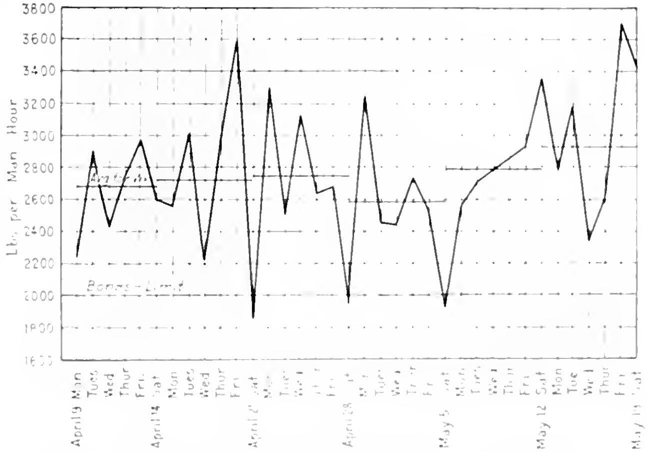


FIG. 5 PROGRESS RECORD USED IN CONNECTION WITH TRUCKING BONUS—DAILY RECORD

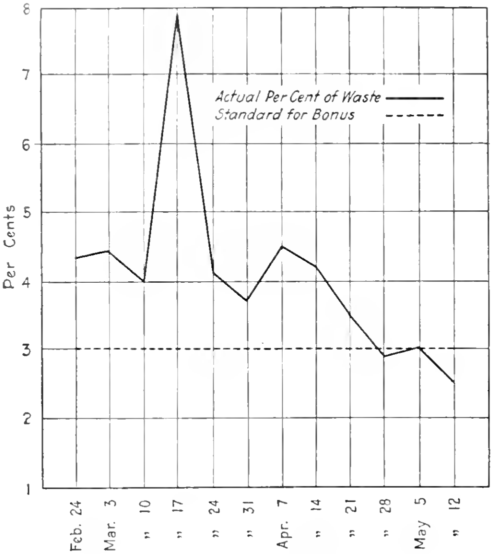


FIG. 6 PASTING MACHINE RECORD OF WASTE—ILLUSTRATING INFLUENCE OF BONUS

The foreman was also one of the recipients of the bonus. It is believed that while the progress record is of value here as a means of encouragement, the bonus method is absolutely essential to success.

It will be noted that:

1. The general average is now better by 34.2 per cent than it was at the start.
2. The scheme has involved no extra cost. It takes about 10 min. of the time of the head of the department each day, and about an hour each week.

TABLE 2. THE BASIS FOR MARKING

MERITS	DEMERITS
A. *Punctuality and Attendance*	
1—At work and on time each day.	½—Late up to 10 min.
1—For each hour overtime at request of department head.	1 —Late up to 30 min.
	1½—Late more than 30 min.
	2 —Absent one-half day.
	3 —Absent one day.
	0 —Absent more than one day (No merits earned).
	1½—Absent more than one day at employee's own request.
B. *Cleanliness and Orderliness About Desks, Files, Machines, Etc.*	
¼—If each evening inspection is passed.	¼—Papers left on top of desk at night.
	¼—Failure to close drawers or cover machines as per desk rules.
	¼—Failure to comply with cleanliness conditions as defined in desk rules.

TABLE 2 *(continued)*

MERITS	DEMERITS
C. *Quality of Work*	
5—Discovery and correction of an error made by another department. (Must be reported to department head at time.)	5—Error discovered outside of department.
1—Discovery and correction of an error in routine checking of work of another department.	5—Each instance where a report is referred back to maker—on account of poor appearance, punctuation, or composition.
D. *Quantity of Work*	
5—Completing each day's task as defined by department head.	5—Failure to complete each day's task.
E. *General*	
5, 10, or 15 for any instance of extraordinary exercise of judgment, tact, or industry which operates to the company's interest and which deserves extra reward.	5, 10, or 15 for any instance of insubordination or discourtesy which is not sufficient to warrant dismissal.

METHOD—Past Comparison of Records

This is to be done along the lines of progress records and after the following method:

There is a possible $6\frac{1}{4}$ merits per day for perfect attendance, quantity of work, and cleanliness of equipment. Let $6 \times 6\frac{1}{4} = 37\frac{1}{2}$ plus $2\frac{1}{2} = 40$ merits, representing 100 per cent. Any merits awarded in excess of these will represent better than ordinary work and therefore will show greater than 100 per cent. Demerits cancel merits and reduce percentage accordingly. Percentages are to be posted by graph each week if desired. All employees except the department heads participate in this plan.

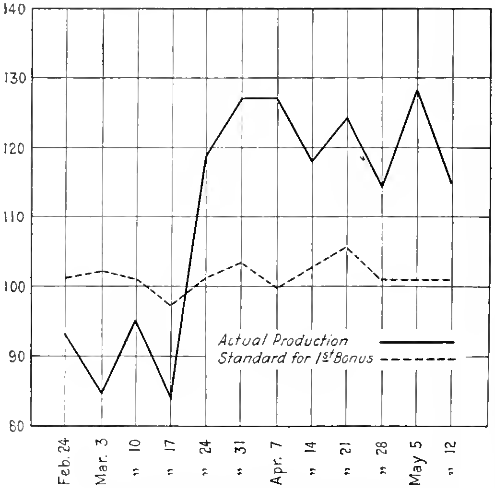


FIG. 7 PASTING MACHINE RECORD OF PRODUCTION—ILLUSTRATING INFLUENCE OF BONUS

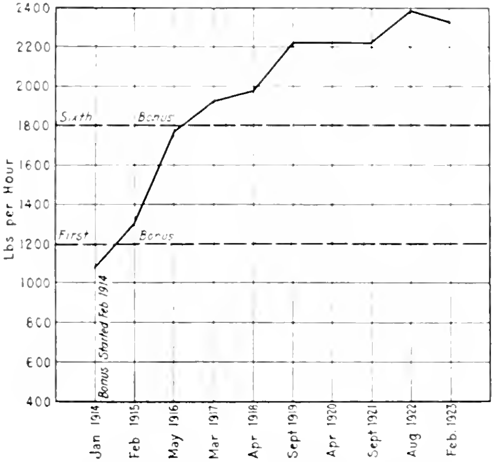


FIG. 8 RECORD OF ATTAINMENT IN POUNDS PER HOUR. FROM PAPER MACHINE ON ONE LINE OVER NINE YEARS

Figs. 6 and 7 show remarkable examples of a splendid result obtained with the aid of the bonus system and later with the aid of the progress record, but particularly they illustrate another and a more important point, the intelligent co-operation of superintendence.

Here both the bonus and the progress chart failed to get the possible results because of the failure of the operators to grasp the possibilities, but under close supervision the operators soon learned to see their way to these possibilities. Once the bonuses began to be made, the operators rapidly improved both the quantity and quality of the work done and maintained it at the maximum.

Fig. 8 illustrates an attainment through the use simply of the bonus system without progress records. Here, it must be understood, the executives, the superintendent, the engineering department and the operator on the machine, whose reward came in the way of a bonus, worked together over a period of years to produce a steadily improving condition—the end of which has not yet been reached. That any such results might be obtained, and, if obtained, might be held without the bonus, is very doubtful.

From these records and charts certain conclusions may fairly be drawn, though they are selected from many. In the first place where no direct reward is offered for improvement, if a reasonable and continuous improvement is expected (and, human nature considered, may be thought to be warranted), there must be one of two conditions present—either the class of performers must be above the average intelligence, or the standard set be one where natural pride of workmanship (which exists in all workers to a considerable degree, especially when in competition), will operate.

Of course, in clerical work, the performers are urged on to better results by expectation of promotion or increased salary, and their work comes more critically and constantly, as to its net results, under the eye of their superiors. There is here a most potent urge, equal to, if indeed not greater than, the reward of piece-work and bonus methods to the direct worker. There is in theory, at least, no limit set by precedent to the ambitious hopes of such performers. Each one sees himself eventually in some executive position, if it be only the head of a department. The scheduling of clerical labor after study, and the progress per cent or merit system have proved of great value.

There are certain operations, as for example the loading of a machine with a given quantity of material, the operation of the machine on the material for a given period, and the unloading of the material in constant repetition, as in a rag thrasher, where the simple progress chart as a tell-tale, if nothing else, is unquestionably effective. This is also true where set times of operation are important to get uniform results.

The progress charts regularly posted at the place of operation are also undeniably effective. Here the obvious necessity of standard operation and visible record became a sufficient urge.

TABLE 3 SUMMARY OF RESULTS OF PROGRESS RECORDS

LOADING OF THRASHERS	Jan	Feb	Mar	Apr.	May	June	July	Aug	Sept	Oct	Nov	Dec
Operator 1	77.0	75.5	86.1	91.0	86.1	88.5	88.0	91.0	90.0	90.1	87.0	91.0
Operator 2	88.0	80.2	85.5	88.0	85.0	87.9	87.9	95.0	91.0	90.0	91.0	96.8
Operator 3	88.2	85.0	83.5	86.5	87.4	83.6	87.0	83.5	86.4	79.0	83.5	82.0
Operator 4			86.8	85.6	81.5	91.0			83.9	81.3	85.3	86.7
Operator 5			87.8	81.0	81.6	89.0	88.0	97.0			85.0	83.0
Operator 6	92.8	91.1	94.0	94.8*	96.2	97.4	94.0		95.8	93.8	97.5	96.8
Operator 7	94.7	93.2	94.2	93.0*	96.2	80.4	92.5		96.3	93.6	95.8	95.2

This operation is one where the standard is based on loading and emptying a rag thrasher with a given amount of rags in a given time. (See Fig. 1.)

SORTING OF RAGS. AVG OF ALL SORTERS	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Room 1	83.0	82.2	77.5	81.1	76.4	70.0	77.1	70.7	73.3	73.0	58.7	74.3
Room 2			90.7	90.5	89.3	87.8	91.0		92.8	91.2	86.7	92.5
Room 3			82.3	81.6	91.4	85.8	87.1	78.9	90.2	85.3	85.0	86.0

This operation is one of sorting good rags from poor rags and per cent is based on inspector's report from overlooking or re-sorting. (See Fig. 2.)

DUMPING OF BEATERS	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Operator 1	98.0	98.5	99.0	99.6	99.0	98.0	97.5	97.5	99.0	98.7	98.1	98.5
Operator 2	95.0	95.0	93.6	96.5	98.0	97.0	96.5	98.5	99.3	98.3	98.2	99.0
Operator 3	93.5	92.6	96.2	97.0	98.1	95.8	97.4	97.3	96.0	98.1	99.1	98.1
Operator 4			93.0	94.0	97.0	93.0	96.0		94.5	96.9	95.8	98.1
Operator 5			84.0	97.5	92.0	94.8	99.0		97.2	93.8	96.3	97.5
Operator 6			92.0	94.0	94.9	96.0	97.0		94.6	97.0	96.2	97.3
Operator 7	98.8	99.6	99.6	99.6	99.0	99.6	99.3		99.5	99.8	99.9*	99.8
Operator 8	99.3	98.2	99.1	99.1	100.0	99.9	99.4		100.0	99.9	99.9*	99.8
Operator 9	98.9	98.1	99.8	99.8	99.8	99.3	99.8		99.5	99.6	99.8*	99.9

This operation is based on preparing material in a beater in set time. (See Fig. 3.)

MACHINE SAMPLES WEIGHT AND STRENGTH	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec.
Operator 1	94.0	95.0	91.0	95.0	96.0	95.0	94.0	96.0	98.0	98.0	96.0	91.0
Operator 2	97.0	98.0	97.0	98.0	98.0	97.0	97.0	97.5	89.0	98.5	98.0	97.0
Operator 3	98.0	98.0	96.0	99.0	98.0	96.0	98.0	97.0	91.0	98.5	97.0	93.0
Operator 4	90.0	96.0	93.0	93.0	94.0	93.0	90.0	79.0	89.0	98.0	93.0	90.0
Operator 5	93.0	97.0	96.5	91.0	94.0	96.0	91.0	97.0	96.0	99.0	93.0	97.0
Operator 6	86.0	97.0	96.0	91.0	97.0	92.0	88.0	93.5	93.0	93.0	95.0	93.0

These per cents are based on making paper on a machine with set standards of weight and strength.

STEAM GENERATION	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Operator 1	74.2	74.5	74.8	74.5		75.0	75.2	74.9	74.7	74.8	73.9	73.5
Operator 2	74.0	74.8	74.5	73.8		75.3	75.4	75.0	73.0	73.4	74.2	72.5
Operator 3	73.8	74.9	74.9	74.8		75.3	75.3	76.0	74.9	74.2	74.3	74.0
Operator 4	73.5	74.8	74.8	75.0		75.1	75.0	76.2	73.4	74.8	73.9	72.6

* See Chart

In the matter of quality, where the payment of a bonus seems undesirable or impossible, the visible and running chart records have proved of value if only to indicate necessary changes of men or machinery. The main necessity, however, of increased production to standard quantity and quality, and with decreased waste, demands an effort rather greater than what most men consider as coming under the contract of a fair day's work. It brings about an improving condition which creates in the mind of the worker a feeling that he is delivering more than was originally expected of him and that he is entitled to greater pecuniary reward. In this feeling there is undeniably great justice and the bonus system alone will meet it over any continued period with a rising bonus for greater improvement.

It must be apparent, however, to those who try the plan, that the progress record or chart is an additional spur since it makes plain not merely the improvements but particularly those cases where the bonus is not made and why. It ought to be said, however, that in the case of either the simple progress record, the bonus method, or the combination, experience has shown very clearly, and in some cases remarkably so, that the great essential is the close co-operation of the management. To put up a chart, to give bonus rewards, and then to leave it to the worker to get results is to court failure, indifference, and even resentment on the part of the worker when expected results do not follow. It is partnership in operation, even in the minor details, that gets results.

No operation is too small for constant study. It is almost a right of the worker that he should be paid for an improvement over what is considered a fair standard. The worker almost invariably improves when given a standard which he can see visibly compared with his actual record. But he always improves when to these is added the advice, assistance, and encouragement of management.

The progress record or chart by itself gets good results. But the progress chart as an illuminating and explanatory picture, with the bonus for reward, fits best the ordinary demand and gets the best results that are humanly possible.

A Study of Clerical Work Improves Methods

By J. HORACE VAN NICE

Class Number 651.53 Records. Arrangement of Files.

OUR planning division methods man discovered that there was an enormous amount of moving around in the space allotted to the division office. Clerks did not work steadily at their desks, and consequently could not accomplish the amount of work they might normally be expected to do. Certain portions of the room were congested and there was a great deal of interference encountered in moving from place to place. The methods man at once placed men at points where the division could be carefully observed to find out the cause of the congestion and the continuous passage of people through the aisles.

The first discovery was that the movement was not caused by restlessness or the desire to visit, but apparently by the fact that each group of clerks had an information unit to which each individual had constantly to go in following up the daily routine. A motion study within groups was instituted with the following interesting discoveries:

Seventy-five per cent of the clerks' time, on the average, was spent in gathering and transferring information. Twenty per cent of the day was actually spent in reading and copying the information, fifteen per cent was spent in waiting in turn with the various other messengers who were busy at the files, and forty per cent of the day was wasted in moving around between desks and information files. In other words, the clerks were working under a terrible handicap which reduced efficiency and therefore made it necessary to hire more help than the job actually warranted.

Final analysis showed that each clerk was interested in only a small section of the information file. It was therefore determined to change the system to one of duplicate files. Any information received by the file clerks thereafter was written in duplicate, triplicate, or even quadruplicate, according to a definite schedule for each class of information. The work was done on a typewriter by using carbon paper. Therefore, each clerk was supplied with a carbon copy of information applying directly to his portion of the work, while the original remained in the regular files for the use of people from other departments and for permanent record.

Each desk has thus become a complete office for the particular employee occupying it, because all the latest information is available in an individual desk file. This file is kept up to date through the receipt of new cards sent out from the master file by office boys. Old cards are destroyed, and therefore the file is live, compact, simple, and ready for instant use.

Not only have the aisles become cleared of traffic, but each clerk is now able to do much more work than formerly. Therefore the size of the planning division has not been increased to correspond with the increase in other parts of the organization.

The desk file installation has been systematized so that records of all information find their way, as formerly, to the regular central files. There is a much better understanding of each job as a whole due to the fact that the executive in charge of the department has decided to whom each class of information should be routed, and clerks who formerly looked aimlessly through the files now have exactly what they need instantly available.

A few changes in methods, therefore, produced remarkable economies in quantity and quality of work.

The Organization of Modern Industry

III—Economic Principles Underlying Factory Growth

By DEXTER S. KIMBALL

Dean, College of Engineering, Cornell University

ONE of the most striking features of modern industry is the increase in the size of factories and other industrial enterprises. A few years ago a plant employing 1000 men was considered a large concern. Today, factories employing 5000 men are common, factories employing 10,000 men are not unusual, and a few plants have employed as many as 25,000 men within the confines of a single yard. A number of large corporations owning several industrial plants in different localities employ much greater numbers of workers. Statistics show that the number of corporations as compared to privately owned enterprises and partnerships tends to increase, thus indicating a tendency towards mass financing and constant growth in the size of industrial undertakings.

There is a general tendency, also, toward specialization of industry. A few years ago it was common practice for manufacturing establishments to produce a very great variety of products. Today the general practice is to confine the activities of an industrial plant to a somewhat restricted range and in many of the newer industries a very limited number of products are produced. There are a number of reasons for these noteworthy tendencies, but only the most important ones will be discussed here.

Industrial enterprises tend to increase in size in one of three ways. The first is by natural growth in size of a single plant or by *aggregation* as it is sometimes called. The second method is by *integration;* that is by extending the control over the supply of raw materials or the disposal of finished products by acquiring the methods and processes that are concerned in these operations. The third method is by *consolidation;* that is by combining industrial undertakings of a similar character under one management whether these undertakings are single plants or integrated industries. The economic reasons for this tendency toward growth and expansion may be conveniently divided into two groups: First, economies that lead to reduced cost of production; and second, economies that give greater competitive power. Aggregation, or the growth of individual enterprises, will be briefly discussed first.

Low productive costs are in themselves, of course, great aids to competition, but aside from this advantage the large plant has certain advantages in competition, merely because of its size. The prestige and influence of a large factory assist materially in selling its product because of the apparent stability and permanency that it suggests. The same principle holds true for the large store which, because of wide advertising, can keep itself before the public. The large enterprise, also, is in a better position than the smaller one to acquire patents and trade secrets.

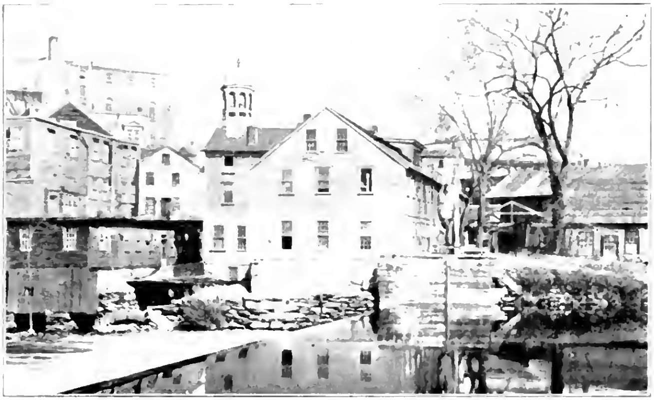


FIG. 19 THE SLATER MILL IN PAWTUCKET, RHODE ISLAND
The first power-looms to be used in the United States were installed in this building about 1790.

The greater part of the advantages of the large individual enterprise lies, however, in its ability to reduce productive costs. Thus the large plant can purchase in greater quantities and consequently at lower prices. The large plant can, in general, command the services of higher salaried leading men and thus increase its efficiency in technique and administration. To these and other reasons must be added certain economic advantages that are inherent in large-scale production. The labor cost of operating a large locomotive is no greater than that of operating a small one, but the work performed in the two cases may be vastly different. The labor cost of a ton of pig iron decreases as the size of the furnace increases. It does not follow as axiomatic that the larger the plant, the

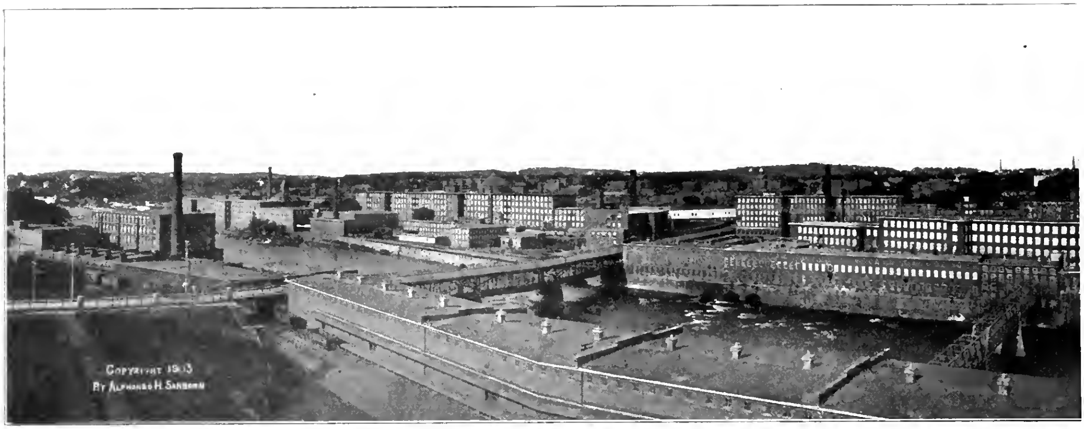
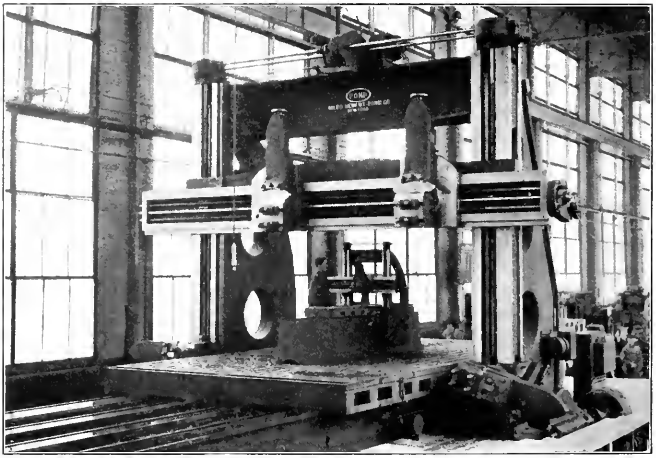


Fig. 20 A General View of One of the Largest Textile Plants in the

lower will be the cost of production because, as we shall see, other factors such as the interest on investment enter into all such considerations. It may be noted in passing, also, that there are reasons for growth other than those that have been noted. The very size of certain modern products demands equipment unthought of years ago. The first locomotive was a mere toy compared with modern locomotives, and the building of a 50,000-ton ship involves an undertaking the size of which would have appalled a shipwright of 100 years ago. There are certain other enterprises, such as gas plants, water works, and transportation facilities that must grow naturally to keep pace with population, and the growth of which may not necessarily be governed by any of the conditions noted in the foregoing. It should be noted that this general reasoning applies also to distributive industries such, for instance, as the great retail department stores.

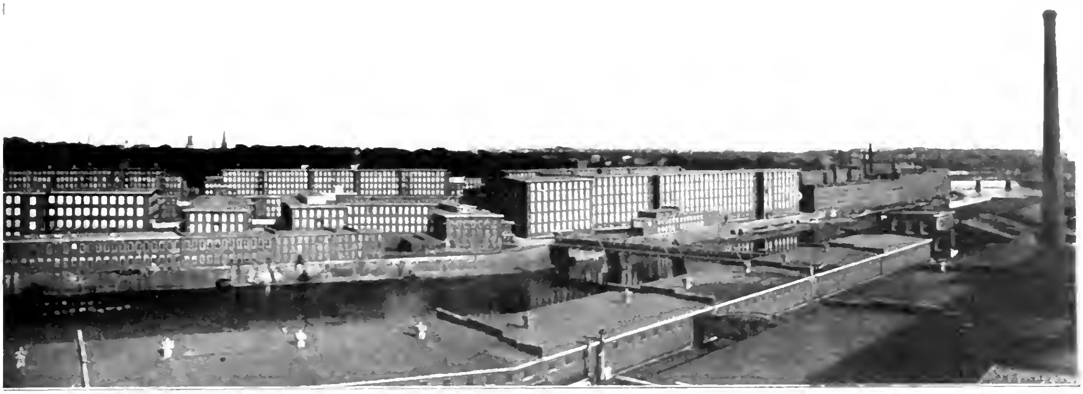


Courtesy of Niles Bement Pond Co

Fig. 21 A 16 x 25 ft. Metal Planer
On the platen is shown a standard 26-in. planer as a striking comparison

The most important reason, however, for the growth of industrial enterprises is the opportunity that increased size affords for applying transfer of skill and division of labor, for, as will be seen, the economic use of these principles depends primarily upon the volume of work to be performed. It is often necessary to apply transfer of skill for other than economic reasons, as for instance, the necessity of securing accuracy. If cylindrical surfaces of great accuracy must be had, a grinding machine is an essential requirement whether it may or may not reduce the cost of production. Again, it is often necessary to build expensive drilling fixtures or similar apparatus involving transfer of skill simply to secure interchangeability of product, though such apparatus may actually increase the productive cost. In most instances, however, the financial relations between the cost of labor-saving or time-saving tools must be considered in connection with the probable reduction in cost. These relations may be briefly stated thus: Will the total savings due to reduced productive costs during the life time or the period of use of the new apparatus more than equal the additional investment? In computing the productive costs such items as interest and depreciation must, of course, be taken into consideration.

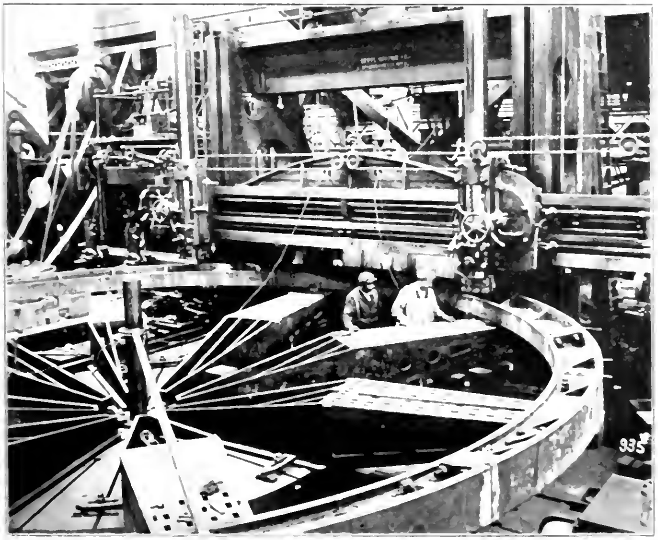
These relations may be made clearer by assuming a simple case where interest may be neglected and labor costs and depreciation only considered. Suppose that the labor cost of a certain operation is $1, when performed with ordinary standard machines. Suppose also that by making a new piece of special apparatus



UNITED STATES—THE AMOSKEAG MILLS IN MANCHESTER, NEW HAMPSHIRE

costing $80 the labor cost can be reduced to 10 cents, which would be a very reasonable assumption in applying such apparatus. The saving of labor in productive cost on each operation will be 90 cents. If only one operation is performed the cost, including the cost of the new tool, will be: $\frac{\$80+0.10}{1}=\$80.10$ and if 2 operations are performed the cost for each operation will be $\frac{\$80+2\times0.10}{2}=\$40.10$. The corresponding cost for 10 operations will be $8.1, and for 89 operations the cost will be close to $1. That is to say, there will be no gain in using the new method unless the operation is to be performed more than 89 times. For 500 operations the cost will be 26 cents and for 1000 operations the cost will be 18 cents and so on, the cost constantly decreasing as the number of operations increases, until with an infinite number of operations the cost will be 10 cents. It will be noted that the effect of the cost of the tool upon the cost of production decreases very rapidly at first and the effect upon the cost of even a small number of operations is very marked. When the quantity is small the influence of the cost of the apparatus is great; but this influence decreases rapidly as the quantity increases, becoming negligible when the quantity is very great, provided, of course, that the apparatus will stand the wear and tear incident to a large number of operations.

It will be clear, therefore, that the question of whether it will pay to use improved tools or methods depends primarily upon the quantity to be made. The greater this quantity the more complete and costly may be the investment in special tools. But the more complete and efficient the tools the lower may be the cost of production; and a decrease in productive costs s t i m u l a t e s the demand for the product. This in turn increases the number to be made and permits the use of even better tools and processes. Thus we have an ever-widening cycle limited only by the available market, and in the case of some products which are desired by, or necessary for all, and where the cost of the material used is not great, as in watches, the limit of production is practically set



Courtesy of Consolidated Machine Tool Corporation

FIG. 22 EXTENSION BORING MILL SWINGING 16 FT. WITH HOUSINGS FORWARD AND 30 FT. WITH HOUSINGS BACK

It is shown turning a large ring in the plant of the Newport News Shipbuilding and Dry Dock Company.

only by the size of the population. When the quantity to be produced becomes very great, as in the production of guns, watches, typewriters, shoes, automobiles, telephones, sewing machines, etc., the advantages of transfer of skill and transfer of intelligence can be most fully realized, much of the machinery employed being of the full-automatic type and highly efficient.

In the example discussed in the foregoing the actual cost of the new apparatus was included directly in the cost of production in order to show its influence upon these costs. There would also be other manufacturing expenses that would have to be included in this cost, but they would be fairly constant, and have been omitted for simplicity. The disposition of the cost of improved machinery should be carefully considered, otherwise it may prove to be a source of loss rather than gain. Obviously, in the foregoing example if the number of operations is to be limited and the new apparatus discarded when these operations are completed, the only safe way is to include the cost of the new apparatus directly in the cost of production as indicated in this example. The more special in character the new apparatus is, the more care should be taken to bury its value directly in the manufacturing costs with which it is concerned. It is not always convenient to do this, however, as the new machine or apparatus may be such as will be employed over a long period of time and the most convenient manner of recovering its cost is by the usual methods of depreciation, the amount allowed for depreciation going, of course, into productive costs. But even here great care should be taken to insure, that, over the period of producing life alloted to the machine, the volume of work that it performs will warrant its installation on the basis of the principles discussed in the foregoing. It is not sufficient that the new machine or apparatus in question can reduce the labor cost on a single operation. There must be sufficient quantity to insure a return on the investment. This principle holds true for single pieces of new apparatus for new departments that may be projected and for the enterprise as a whole. This economic principle is perhaps the most important one underlying modern mass production, and a failure to recognize it has been responsible for not a few commercial failures.

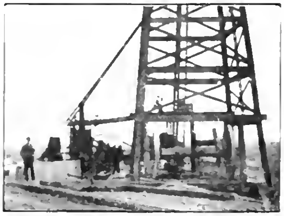
The second important principle that has influenced the growth of industrial enterprises is division of labor. This is the oldest economic principle of production known to us and is in reality the basis of all civilization. From time immemorial man has recognized that as he concentrates his efforts his skill in his chosen calling rises and the quantity of his product increases. In recent times the very growth of human knowledge has rendered it imperative for all of us to limit our fields of activity both mental and manual. The term division of labor has, from long usage, become associated in the public mind with manual processes. But productive labor is both *mental* and *manual*, and just as there may be division of manual labor, so there may be division of mental labor or division of thought. Modern methods of production tend naturally and constantly to separate mental labor from manual labor and to subdivide each group into smaller subdivisions of activity. Subdivision of manual labor has been greatly advanced by the extended use of tools while subdivision of mental labor has been greatly advanced by the great increase in human knowledge. The designing of machinery and structures, for instance, is performed entirely apart from the actual work of construction; railroad schedules are laid out by men who do not need to see the road itself, and the plans of great commercial organizations are perfected before operations are commenced. This is natural since we habitually *think* before we *act*, or at least should do so.

The application of this principle is widespread and is seen in all industrial and commercial undertakings. There is one application, however, that deserves special notice. In all factories and engineering works the mental work of planning, so far as engineering design is concerned, has long been separated from the actual work of construction, and the science of engineering is an outstanding example of the separation of mental work from manual work. There is always, however, a considerable amount of planning to be done in connection with actual construction. All actual productive processes, both mental and manual, were originally performed in the shop itself and in direct connection with the work. In the case of small shops this is often still the case. For a number of years, however, there has been a tendency to separate this productive planning from the actual work of production in the same manner as engineering planning was separated some time ago. As works have grown in magnitude, the continued application of the principle of separating mental and manual processes has taken out of the shop a large part of the planning of productive processes and placed it in separate auxiliary departments. The basic feature of so-called scientific management is to separate mental and manual processes down to the very roots of productive industry.

Scientific management aims to do the mental labor of production in a separate planning department, and to predict the results of productive processes in a manner analogous to that in which the engineering department controls the engineering design of the product. Viewed from this angle these seemingly new ideas appear to rest upon sound economic foundations and, no doubt, many of these methods will, in time, become permanent features of industrial management. The question of the rapidity of their adoption depends not so much upon economic grounds as upon the ground of expediency.

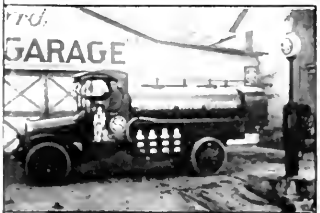
It is not usually easy to compute accurately in advance the gains that may be made by an application of division of labor, because of our general lack of knowledge of the possibilities of human effort. Estimates, of course, can always be made. If the subdivided work is to be performed on machines whose capacity is known, much more accurate predictions can be made.

The limitation to the application of division of labor is, as in the case of improved machinery, the quantity to be produced. Thus if a certain piece of work involves 10 operations it would not be economy to employ 10 workmen if the total amount of work to be done employs the time of only one man. A grocer who can handle adequately all of the details of his small business and whose sales are limited by territorial restrictions would not be justified in hiring a



THE BAYONNE, NEW JERSEY, REFINERY

A TANK STEAMER



AND AUTOMOBILE FILLING STATION

THE INTEGRATED INDUSTRY OF PRODUCING, TRANSPORTING, REFINING AND DISTRIBUTING OIL porter and a bookkeeper on the sole theory that division of labor was an enonomic principle that would lower his costs. If there is volume enough, division of labor may be economically extended to a great degree of refinement; but, again, the number of operations may be so small that the efforts of one man may supply the demand and any division of labor would result in financial loss. The influence of this principle upon the growth of industrial enterprises is obvious. And it should be noted that this influence applies to industries other than manufacturing, as can be seen by a study of great department stores and other mercantile establishments.

Growth in the size of an industrial enterprise by integration is a very different phenomenon. Here an effort is made to acquire so far as possible control of all the stages in manufacturing and distributing a line of commodities from the raw material to the finished product. The United States Steel Corporation is an excellent example of an integrated industry, since it owns its own mines, methods of transportation, and an equipment of furnaces and rolling mills and other fabricating plants, that produce a great variety of marketable product. The Standard Oil Company is another classical example of an integrated industry. The advantages enjoyed by an integrated industry are manifest. It does not depend upon any other company for its principal materials and thus can insure a constant supply of such materials. It saves the profits of many middlemen for its own treasury and by skilful rearrangement can assign to each fabricating plant the special work for which it is best fitted, and which its geographical position seems to warrant. It may even establish new fabricating plants in strategic places to control the market better. Large integrated industries often have excellent opportunities to develop by-product plants that in themselves may be large undertakings, thus adding still further to the size of the enterprise. The most striking example of this type of integration is the packing industry. A few years ago about one-third of the weight of a live ox was considered waste material. Today the entire animal is worked up into some form of marketable product, these products including glue, buttons, hair-pins, printer's ink, and a number of other useful articles.

Consolidation, as has been stated, consists in combining under some single form of management several industrial enterprises of like character. The enterprises combined may be single plants or they may be large integrated industries. A good example is the Worthington Pump and Machinery Company. The productive advantages consist of the possibilities of rearranging the work of each plant so as to secure the greatest quantity of each product in one place, and also giving each plant the line of work best suited to its location and equipment. The great advantage, however, is competitive, since such a consolidation can more definitely control market prices. There are many examples of consolidation where a number of large competing companies have consolidated in the manner described largely to eliminate destructive competition. It should be noted that such combinations, in common with integrated industries, have at times become so powerful, and have dictated market prices to such a degree as to evoke federal legislation against such practices.

Concurrently with integration and consolidation there has been, as stated, a general tendency toward specialization in industry. Specialization is, of course, based upon division of labor and the general advantages and disadvantages of this principle apply to specialization. A few years ago it was common to find single establishments producing many and varied lines of product. As the industrial field broadened and as com-

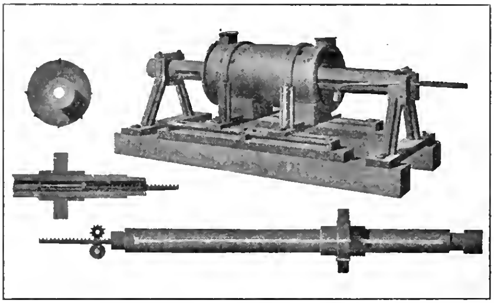


FIG. 23 WILKINSON'S BORING MACHINE
Used in machining cylinders of Watt steam engines.

petition became keener manufacturers and merchants found that they could secure better results by concentrating upon a few lines and obtaining greater quantity in these selected lines, since, as has been shown, cost of production depends largely upon quantity. This tendency toward specialization has been hastened also by the great increase in technical knowledge and the difficulty of keeping up with this increase in knowledge in several lines of work. Then again many new industries of narrow scope based upon patents or special chemical or mechanical processes have appeared as illustrated by cement plants and chemical works.

A most important phase of this development has been the growth of plants that manufacture auxiliary tools and supplies. A few years ago, for instance, every large plant made its own taps, dies, hammers, etc., in a small way and necessarily they were expensive. But as the field of industry broadened, small manufacturers noted that by manufacturing these supplies in quantity they could sell them to other plants at much lower price than these plants could produce them in small lots. The general result has been that the average factory or commercial establishment of today is no longer self-sufficient to its purpose, but depends upon many sources not only for its raw material, but also for the greater part of its tools and appliances, great and small. And in many cases these plants that manufacture auxiliary tools and supplies have themselves grown into large enterprises.

A most interesting part of this growth toward specialization is found in the machine tool industry. There was a time, of course, when industrial plants made all of their own tools and appliances. But long ago it was recognized that the building of tools, to be used in building machinery, in general, offered an attractive field of specialization which was rather distinct. The building of the *master tools of industry*, that is, the class of tools known as machine tools and illustrated by the lathe, the drilling machine, and the planing machine, now stands out as a separate industry. The construction of machines of all kinds depends upon the possession of these master tools. Space forbids any discussion of these basic implements, but they are a very interesting development. Not the least important feature of the development of these basic machines is the extreme accuracy with which they are built and the corresponding accuracy of their product. James Watt congratulated himself when he succeeded in producing a steam engine cylinder, the bore of which varied from being truly circular in form only one-half inch or so. A modern automobile cylinder that is more than a few thousandths of an inch from the true dimensions would not pass inspection in a first-class automobile factory, and basic gages of measurement that are accurate to the one-millionth of an inch are no longer considered unusual. This remarkable accuracy is of great importance since it has made possible modern *standardization* and *interchangeability* so closely associated with mass production and which will be discussed in a succeeding article.

As specialized industries increase in size, there is often a tendency toward integration that should be noted. It may occur that an enterprise in the early days of its existence may find it advantageous and economical to purchase many of its auxiliary parts, supplies, and tools. As the business grows, however, there may come a time when the required quantity of a given kind of supply becomes sufficient to warrant the installation of equipment to manufacture it, thus saving the profit formerly paid to the supply man. The great electrical manufacturing companies in this country are excellent examples of this form of integration. Originally they depended largely upon auxiliary industries for many of the manufactured parts that went into their product, but now they manufacture many of their own accessory parts such as those made of porcelain, oil cloth, copper cables, mica products and others that formerly were supplied by specialists in these commodities.

These specializing influences have also affected the workers in these industries. This is particularly true in the so-called continuous industries where practically no flexibility exists in the character of the process to be performed, each process being performed by a tool or process specially designed for this function and no other. These influences, specialized machinery and the resultant division of labor, have produced some remarkable results. A few years ago and within the memory of the writer, the shoemaker measured the customer's foot and made the shoe or boot completely himself. Today the work of making a shoe is divided up into a large number of operations for each of which a special machine has been devised which embodies such a large amount of transfer of skill as to reduce the skill and knowledge required of the operator to a minimum. Such an operator may spend his life sewing one kind of a seam or running a nailing machine for nailing on heels. Shoemaking as a trade has disappeared and in its place we see one of the most highly specialized of industries. The economic dangers that face such an operator are obvious. A change of process, or a new invention may eliminate almost instantly his entire calling and at the same time the high degree of specialization required in many callings makes it very difficult for the worker to change to a new one, if the old one fails him. The constant tendency is to make the gap between the worker and the ownership of the tools of industry wider and wider. There is a consequent necessity of legal and other methods of regulating industry to protect the worker against these dangers over which he has no control, and against the action of which he is usually helpless.

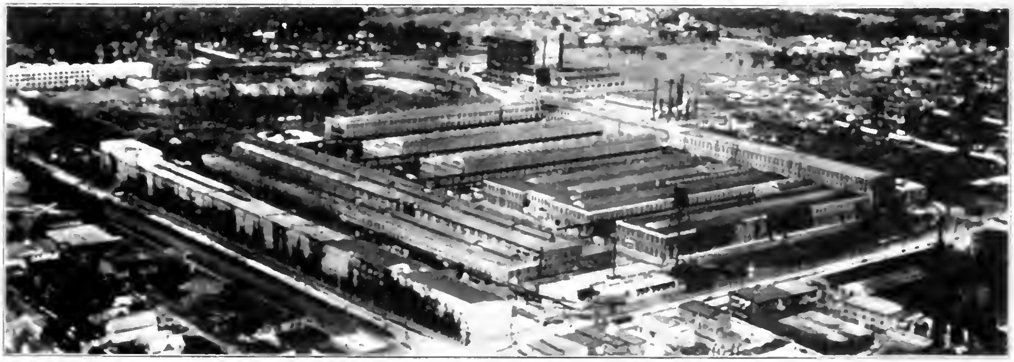


FIG. 24 AIRPLANE VIEW OF THE ALLIS-CHALMERS PLANT IN MILWAUKEE, WISCONSIN

It will appear from the foregoing discussion that the most important economic principles that underlie the production of commodities are division of labor, transfer of skill, and transfer of thought. It has been shown, also, that the limiting factor in the application of these principles is the quantity to be produced. It may be stated, therefore, as a general principle that:

The unit cost can, in general, be decreased as the quantity to be produced increases. This statement may be called the "law of increasing productivity."

(To be continued in the October issue)

Classifying the Office Worker

By WM. LEAVITT STODDARD

IN a wage scale investigation the classification of occupations is essential before data on rates of pay can be collected and compared. This fact became speedily apparent when, a few months ago, the Boston Chamber of Commerce, through a special committee, undertook to begin a system of collecting information about salaries in the clerical profession.

The underlying purpose of the study was to establish a system for the gathering and dissemination of data about wage rates. The committee was composed of men keenly interested in the subject—a representative of an insurance company, two from manufacturing plants, one each from a department store, a trust company, the business school of Harvard, and the staff of the Chamber itself.

We found that it was possible to group the commonest office occupations into seven classes:

1. Stenographers, dictating machine operators, typists.
2. Bookkeepers—ledger clerks; accountants—statistical, cost figuring, pay-roll figuring clerks.
3. Correspondence and order clerks.
4. Telephone operators, telegraph operators, information clerks.
5. Machine operators (except bookkeeping, adding, statistical or dictaphone), i. e., addressograph, mailing, multigraph, perforating, blue-print machine, and the like.
6. Mail clerks and messengers.
7. Miscellaneous clerks and file clerks.

No one in these classes, it will be seen, is an executive in the commonly accepted sense of the term. The committee did not consider the executive; it considered only the rank and file.

I desire to call particular attention to the analysis made of the first group—the stenographic. The general definition of employees in this group is "clerks with ability to make, read, and type stenographic notes and perform such incidental typing and clerical work as may be required." The full classification follows:

STENOGRAPHIC GROUP

Stenographer, Grade I. Definition: Clerks with ability to perform stenographic work of the highest technical nature which requires specialized training, unusual skill, accuracy and reliability, together with a general knowledge of the company's business, and a particular knowledge of the business methods and procedure of the subdivision in which employed; to act as stenographic-secretary to officers of the company or managerial executives and relieve them of details of office work, or to supervise and control the work of other stenographers. Special training in business school required, together with high school or college education or equivalent.

Stenographer, Grade II. Definition: A clerk with ability to perform ordinary stenographic work requiring ability to make and transcribe notes, a limited knowledge of the company's business routine, and ability to type with speed and accuracy.

Stenographer, Grade III. Definition: A clerk with ability to make and transcribe stenographic notes of the simplest character, no knowledge of the company's business procedure or product required. Limited training in commercial school and grade school education essential.

Class Number
651.374 Office Employees.
Classification.

TYPIST GROUP

Typist, Grade I. Definition: 1. Clerks with ability to type with a high degree of accuracy and skill from dictaphone records, or to do copying work of an involved and technical character with speed and precision; work requires high school education or its equivalent and skill gained from brief special training in school or from experience.

2. Clerks with ability to operate, with a high degree of skill and accuracy, billing machine, or other mechanical typing device in ordinary use in office. High school education or its equivalent and skill gained from brief special training in school or from experience essential.

Typist, Grade II. Definition: Clerks with ability to type the simplest forms of copy work with mechanical skill; grade school education essential; no special training in the operation of machine, and only brief experience required.

STENOGRAPHER, ORDINARY

Qualifications: High school education or better. Special training or experience giving facility in making shorthand notes or operating any standard typewriter. Ability to use good English and the Dictionary. Sense of form and style of office letters, forms, simple tables, and the like.

Duties: Under supervision to take dictation and transcribe notes or dictaphone records accurately and rapidly. To perform incidental clerical work, including correspondence filing. To copy written or printed matter as under "Typist."

TYPIST

Qualifications: High school education. Experience or training in operating any standard typewriter and copying from written or printed matter or from dictaphone records. Knowledge of spelling. Sense of form and style of ordinary copy. Ability to read handwriting and to supply obvious deficiencies in the copy.

Duties: Under supervision to copy or transcribe from records accurately and rapidly and to perform incidental clerical work.

The entire classification is to be tested in practice by submission to representative business houses with the request that the rates paid for the several classes of work described be inserted and returned to headquarters.

The clerical workers of this country are a great and an increasing army. Recruited largely from women and girls, too often without adequate training, the burden imposed by their employment both on management and on themselves is oftentimes nearly intolerable. Conscientious study and improvement in this field promises handsome returns, and it should be done with as much care as others have used in studying and classifying the work of men at the semi-automatic machines in our shops and factories.

Two Practical Cases of Task-Setting

Formulae Used for Punching and Button-Sewing

By CHARLES N. UNDERWOOD

[illegible]

Class Number
658.5421 Time setting
658.9: 621.96 Punch Presses

FOR years the necessity for recording unit times obtained from time studies has been recognized and many efforts have been made, with varying degrees of success, to tabulate the data in order to make it available for future use, and so eliminate the necessity for duplicating the work when studying operations containing similar elements. In many instances the chief difficulty has been that the elements recorded were not really short enough to be elemental and the description of each element was entirely too brief to describe it accurately. In many cases, after the lapse of a short time, it has been found that such collections of data were valueless for further use and they had to be disregarded. By making the elements as small as it is possible for one to read the stop-watch, and by accurately describing all of the motions involved in the element, together with the surrounding conditions under which the work is being done, as, for instance, the location of the work with reference to the workman's position, it is quite possible to tabulate data so that they may be used in future work. When sufficient unit times have been so tabulated, and proved accurate, task-setting becomes rapid and the waste due to the duplication of effort is eliminated. When sufficient data have been accumulated it is sometimes possible to derive formulae for setting tasks on similar operations.

Thus, in cases where detail time study would be relatively too expensive, it is often possible to establish correct times on jobs by calculation, using the data from previous investigations. Even where the job in question is important enough and of sufficient duration to warrant special study, the cost of such an analysis can frequently be avoided by the application of sound formulae, based on careful past experience and tested for accuracy by actual operation.

Formulae for Typical Industries

Task-setting is essentially the application of mathematics to production. Because the fundamentals of production have not yet been determined by research, rigid mathematical analysis is not possible. Recourse must be had to experimental methods and empirical formulae, as has been the case with all sciences and engineering, until such time as the basic laws may be discovered which will make exact mathematics possible. With due care in derivation, empirical formulae can be developed from correct investigations.

Two formulae derived and successfully used for many years with excellent results will be described below. These two formulae or rather sets of formulae are taken from two entirely different industries which are as follows:

1. Blanking and piercing and blanking on punch presses.

2. Button-sewing on men's sack coats.

In the first case we have a machine operation, working on steel, an operation usually performed by men, while in the second case we have a purely hand opera-

TABLE 1 UNIT TIMES FOR PUNCH PRESS ELEMENTS

Blank and Pierce and Blank Coil Stock

	Operation	No. 2 Bliss: Double Roll Feed	No. 2 Bliss: Single-Roll Feed, On Right: Scrap Wheel	No. 2 Bliss: Single-Roll Feed, On Left: No Scrap Wheel	No. 2 Bliss: Single-Roll Feed, On Left: Scrap Wheel	No. ? Blake & Johnson	No. 73 Bliss	No. 20 Bliss
A	R. P. M. of Press	140	140	147	147	133	136 / 88	128 / 90
	Min. Per Stroke	0.00714	0.00714	0.0068	0.0068	0.00752	0.00735 / 0.01137	0.00782 / 0.01112
B	Put on New Coil—Reel	2.50					3.00	3.00
	Put on New Coil—in Box	1.00		1.40	1.40	2.10		
	Put on New Coil, Straighten and Start		3.00					
C	Take Care of Scrap	0.60	0.60					
	Blank Out End			0.30				
	Remove Scrap From Die						0.35	0.35
	Blank Out End and Connect Coils of Scrap				0.90	0.90		
D	Empty Pan and Make Out Ticket	2.50	2.50	2.50				
	Remove Coil of Scrap				2.30	2.30		
	Coil Scrap and Bind						3.00	3.00
E	Change Card	3.00	3.00	3.00				
	Start Coil of Scrap					0.75		
	Empty Pan and Make Out Ticket				2.50		2.50	2.50
F	Clean Up	6.00	6.00	6.00				
	Empty Pan and Make Out Ticket					2.50		
	Change Card				3.00		3.00	3.00
G	Oil Machine	3.00	3.00	3.00				
	Change Card					3.00		
	Clean Up				6.00		6.00	6.00
H	Tool Trouble	10.00	10.00	10.00				
	Oil Machine				3.00	3.00	3.00	3.00
J	Coil Trouble	8.00	8.00	8.00				
	Clean Up					6.00		
	Tool Trouble				10.00		10.00	10.00
K	Fill Oil Tank	3.00	3.00	3.00				
	Tool Trouble					10.00		
	Coil Trouble				8.00		8.00	8.00
L	Coil Trouble					8.00		
	Fill Oil Tank				3.00		3.00	3.00
M	Fill Oil Tank					3.00		

tion on soft materials and one that is, in most cases, performed by women.

In the factory where the blanking data were derived there were a great many punch presses and these were of 8 different types, running at different speeds for special work. Some were equipped with double-roll feeds; some equipped with single-roll feeds; some equipped for hand feeds; some had scrap cutters; some had scrap reels; and some had neither. After several hundred studies had been made on these machines, the unit times of which had been carefully recorded, we began to analyze the data with the view to cutting down the amount of work entailed in setting tasks on blanking, and piercing and blanking operations.

These operations were first divided into two main classes as follows:

(*a*) Coil stock used.
(*b*) Strip stock used.

Each of these divisions was treated separately, due to the fact that the material, in each case, was handled in a different manner.

(*a*) *Coil Stock Used.* The first thing done was to tabulate on a form shown in Table 1 the unit times for each necessary element in the operation for each kind of press. These figures were inserted only after they had been checked over from many successful time studies previously made. Then with these data before us, we were able to derive a formula for each type of press under each condition. Under this head we had three cases:

1. Order more than one day's run.
2. Order less than one day's run—one coil of stock used.
3. Order less than one day's run—more than one coil of stock used.

For the purpose of illustration we will carry through the derivation of the formula for time allowance for the case of coil stock, order more than one day's run, with the coil of stock on the reel, on a No. 2 Bliss Press with double-roll feed.

The unit times recorded for the various operations are the times actually needed to perform them, when no interference of any kind occurs, and when no time is lost in their performance by the operator making any false motions. Obviously, under operating conditions, it would not be expected that an operator could maintain these times for any length of time. Study and experience have taught us, however, that once the actual "time needed" to perform an operation is known, an allowance, in the form of a per cent of the "time needed," added to the "time needed" will bring the accomplishment of the "time allowed" well within the capabilities of a good, experienced workman. When an operation is entirely a hand operation this allowance will vary with the kind of work being done. Heavy work requiring much muscular energy will demand a higher percentage for "rest and delay" than will an operation which does not require so much muscular energy. An allowance of 10 per cent on automatic machine work has been found to be about the right amount. In the case of our punch presses we have a semiautomatic machine. For these machines an allowance of 15 per cent was used for the machine time required to do the work and 25 per cent for all the purely hand operations. The latter allowance is somewhat liberal; but in view of the fact that the time for purely hand work is but a small percentage of the total time of the operation, the final result is not so liberal as might appear at first glance. A good operator on any job should be able to exceed his task by from 10 to 15 per cent. This will insure the workman against losing his "bonus" due to some unusual condition. Nor can such a task be considered as being too liberal.

As the length of the coil of stock is known from which the pieces are to be made, and also the "advance"

TABLE 2. POWER PUNCH PRESS FORMULAE

Unit Times to Blank, and Pierce and Blank—Coil Stock

Press			Case No. 1 When Order is More Than Day's Run	Case No. 2 When Order is Less Than Day's Run and Only One Coil of Stock is Used: Pan Holds Entire Order	Case No. 2: Pan Does Not Hold Entire Order	Case No. 3 When Order is Less Than Day's Run and More Than One Coil of Stock is Used
No. 20 Bliss Single-Roll Feed		Low Speed	$0.2287+\frac{142.1}{N}+\frac{55.83}{X}$	$0.2227+\frac{454.9}{Y}$	$0.2227+\frac{399.1}{Y}+\frac{54.3}{X}$	$0.2227+\frac{103.5}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$
		High Speed	$0.1607+\frac{142.1}{N}+\frac{55.83}{X}$	$0.1565+\frac{454.9}{Y}$	$0.1565+\frac{399.1}{Y}+\frac{54.3}{X}$	$0.1565+\frac{103.5}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$
No. 73 Blis Single-Roll Feed		Low Speed	$0.2341+\frac{142.1}{N}+\frac{55.83}{X}$	$0.2279+\frac{454.9}{Y}$	$0.2279+\frac{399.1}{Y}+\frac{54.3}{X}$	$0.2279+\frac{103.5}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$
		High Speed	$0.1532+\frac{142.1}{N}+\frac{55.83}{X}$	$0.1474+\frac{454.9}{Y}$	$0.1474+\frac{399.1}{Y}+\frac{54.3}{X}$	$0.1474+\frac{103.5}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$
No. 5 B & J Single-Roll Feed			$0.1548+\frac{67.1}{N}+\frac{68.1}{NS}+\frac{55.83}{X}$	$0.1507+\frac{444.1}{Y}$	$0.1507+\frac{386.7}{Y}+\frac{54.3}{X}$	$0.1507+\frac{65.3}{N}+\frac{66.4}{NS}+\frac{54.3}{X}+\frac{261.4}{Y}$
No. 2 Bliss: Single-Roll Feed	Feed on Right	Scrap Wheel	$0.14+\frac{51.3}{N}+\frac{51.3}{NS}+\frac{55.83}{Y}$	$0.1363+\frac{414.2}{Y}$	$0.1363+\frac{359.4}{Y}+\frac{54.3}{X}$	$0.1363+\frac{50.0}{N}+\frac{50.0}{NS}+\frac{54.3}{X}+\frac{261.4}{Y}$
		No Scrap Wheel	$0.14+\frac{38.1}{N}+\frac{55.83}{X}$	$0.1363+\frac{352.9}{Y}$	$0.1363+\frac{298.9}{Y}+\frac{54.3}{X}$	$0.1363+\frac{37.1}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$
	Feed on Left		$0.1469+\frac{80.5}{N}+\frac{55.83}{X}$	$0.1431+\frac{394.7}{Y}$	$0.1431+\frac{339.8}{Y}+\frac{54.3}{X}$	$0.1431+\frac{67.1}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$
No. 2 Bliss: Double-Roll Feed		Coil in Box	$0.1469+\frac{35.8}{N}+\frac{55.83}{Y}$	$0.1431+\frac{351.2}{Y}$	$0.1431+\frac{296.2}{Y}+\frac{54.3}{X}$	$0.1431+\frac{34.8}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$
		Coil on Reel	$0.1469+\frac{68.9}{N}+\frac{55.83}{X}$	$0.1431+\frac{383.4}{Y}$	$0.1431+\frac{328.5}{Y}+\frac{54.3}{X}$	$0.1431+\frac{67.1}{N}+\frac{54.3}{X}+\frac{261.4}{Y}$

N = No. of pieces in coil. X = No. of pieces pan holds. Y = No. of pieces in order. S = No. of coils on scrap wheel.

of the stock under the punch for the press, it is a small matter to calculate the number of pieces which a coil of stock will make. Likewise, depending upon the size of the blanked piece, the number of pieces which the press pan will hold before it has to be emptied is easily found:

Let N = number of pieces in coil of stock.
Let X = number of pieces pan holds.
Allow 15 per cent for rest and delay on machine time.
Allow 25 per cent for rest and delay on hand time.

The formula for the task for a day's work (10 hr.) is

$$\text{Task} = \frac{600 - 1.25\,(E+F+G+H+J+K)}{1.15\left(\frac{1}{A}\right) + 1.25\left(\frac{B+C}{N} + \frac{D}{X}\right)}$$

Substituting the values of A, B, C, etc., from Table 1 we have:

$$\text{Task} = \frac{558.75}{0.00821 + \frac{3.85}{N} + \frac{3.12}{X}}$$

Then for the time allowance per 1000 pieces in hours.

$$T = \frac{10 \times 1000}{\dfrac{558.75}{0.00821 + \frac{3.85}{N} + \frac{3.12}{X}}} = 0.1469 + \frac{68.9}{N} + \frac{55.83}{X}$$

Using this formula for any piece to be made from coil stock on a No. 2 Bliss Press with double-roll feed, in which the order is more than a day's run and the stock fed from a coil reel, we need only to find the values of N and X.

Formulae covering all of the other conditions for coil stock have been similarly worked out and are given in tabular form in Table 2.

In Table 3 are given, in tabular form, the allowances for the various elements when operating a press with strip stock; and in Table 4 are given the formulae for time allowances for each case.

These formulae have been in constant use for a number of years with uniformly good results. The workmen know that tasks set by this method are fair and accurate and are quite willing to accept them without question.

While it is not advisable to use these particular formulae in shops other than the one in which they were derived, the method of derivation is here shown, and this, together with the tables of unit times for the various elements (Tables 1 and 3) will make possible the derivation of similar formulae to meet the conditions peculiar to the shop in question. Figures given here of time-study data, and, in fact, all time-study data from whatever source, should be used only by one who has had plenty of time-study experience and who appreciates the value and correct use of such data. Otherwise, there is a possibility that they will be incorrectly used, and cause improper tasks to be set, with the result that the confidence of the workman will be lost and the data so used will be condemned as incorrect.

Button-Sewing on Men's Sack Coats

In the men's clothing industry work is done either on day work or on piece work. The task and bonus

TABLE 3 UNIT TIMES FOR PUNCH PRESS ELEMENTS—STRIP STOCK

Blank, and Pierce and Blank—Strip Stock

		No. 2 Bliss Double-Roll Feed	No. 73 Bliss Single-Roll Feed				No. 20 Bliss Single-Roll Feed				No. 5 B & J. Toggle			No. 20 Bliss Hand Feed		No. 30 Bliss Double-Roll Feed	No. 65 W. F. F. Hand Feed	No. 5 B. & J. Single-Roll Feed
			High Speed	Low Speed	Reverse Strip High Speed	Reverse Strip Low Speed	High Speed	Low Speed	Reverse Strip High Speed	Reverse Strip Low Speed	Single-Roll Feed	Double-Roll Feed	Hand Feed	High Speed	Low Speed			
A	R. P. M. of Press	140	136	88	136	88	128	90	128	90	80	80	80	128	90	112	102	133
	Min. Per Stroke	0.00714	0.00735	0.01185	0.00735	0.01185	0.00782	0.01112	0.00782	0.01112	0.0125	0.0125	0.0125	0.00782	0.01112	0.00893	0.00981	0.00752
B	Start Strip	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.10	0.20	0.20
C	Remove Scrap From Die.	0.15	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	Per day 5.00	0.30	0.15
D	Empty Pan and Make Out Ticket	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
E	Change Card	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
F	Clean Up	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
G	Oil Machine	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
H	Tool Trouble	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
J	Strip Trouble ...	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
K	Fill Oil Tank or Cup, or Oil Strip	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	0.10	0.10	0.10		0.10	3.00
	Place Strips on Table															0.10		
L	Tie Scrap	3.00																
	Reverse Strip				0.25	0.25			0.25	0.25								
	Place Strips on Table		0.10	0.10			0.10	0.10			0.10	0.10	0.10	0.10	0.10		0.10	
	Fold Scrap (Per Strip) ...																	0.15
M	Place Strips on Table				0.10	0.10			0.10	0.10								
	Fold Scrap		0.15	0.15			0.15	0.15			0.15		0.15	0.15	0.15		0.10	
	Tie Scrap											3.00						3.00
N	Fold Scrap				0.15	0.15			0.15	0.15								
	Tie Scrap		3.00	3.00			3.00	3.00			3.00		3.00	3.00	3.00		3.00	
O	Tie Scrap ...				3.00	3.00			3.00	3.00								

method of payment was not in use in the market in which these studies were made. Consequently the formulae here derived are for piece prices and not for time allowances. The method of derivation is the same, however, and the data could be used to derive time allowances if it were so desired.

The operation of sewing buttons on coats is done by women. Each clothing house has its own method of sewing buttons on coats, depending largely on the quality of the product which the particular house makes. The number of stitches to each button and the number of times the thread is wrapped about the neck of the button vary with each clothing factory. In double-breasted coats the buttons on the right-hand side are wrapped with a greater number of turns than those on the left side, because double-breasted coats are always buttoned on the right side. The number of buttons on the front of a coat and the number on the sleeves vary greatly with the styles from year to year so that a study on button-sewing, to be of continual service, must be expressed in terms of a formula from which rates covering all conditions can be obtained. In addition, the button-sewers in the various factories do work other than button-sewing in connection with that operation. For instance, in factory A the button-sewers sew the strap-hanger on the inside of the neck of the coat, and in factory B they sew the size ticket on the inside of the neck of the coat in addition to sewing on the buttons.

The unit times for the various elements were obtained by careful studies made on the best workers in two different clothing factories and the studies compared. Although the method of button-sewing, or perhaps we should say, the standard of button-sewing, was not the same in both factories, the elemental times checked in every detail so far as the work of actual button-sewing went.

In factory A the coats are brought to the button-sewer on regular coat-hangers which are hung on a rack at the left of the operator. The button positions have been previously marked by a button-marker. The operator takes a coat from the rack, throws it in her lap, turns up one sleeve and sews on the proper number of buttons, then turns up the other sleeve and sews on the buttons, after which the front buttons are sewed on. The strap-hanger is then sewed in the back of the neck, the coat replaced on the hanger and hung on a rack at the right of the operator, from which it is removed by a supply man. In this particular factory the regular practice in sewing buttons on sleeves is to sew on the first button, and, without breaking the thread, to stick the needle between the cloth and sleeve lining to the position of the next button. This eliminates the necessity for fastening each button, breaking the thread, and fastening the thread again for the second button.

This factory does make a certain line of coats, which we will call the M. F. coats, on which the sleeve buttons are required to be individually fastened.

TABLE 4. PUNCH PRESS FORMULAE

Unit Times to Blank, and Pierce and Blank—Strip Stock

Press			Case No. 1 When Order Is More Than a Day's Run	Case No. 2 When Order Is Less Than a Day's Run: Pan Does Not Hold Entire Order	Case No. 2 When Order Is Less Than a Day's Run: Pan Holds Entire Order
No. 5 B. & J. Single-Roll Feed			$0.1682+\frac{11.2}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.1638+\frac{10.9}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.1638+\frac{10.9}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 65 W. F. F. Hand Feed			$0.2177+\frac{17.7}{N}+\frac{55.4}{X}+\frac{66.6}{NS}$	$0.2121+\frac{17.3}{N}+\frac{54.0}{X}+\frac{64.9}{NS}+\frac{259.7}{Y}$	$0.2121+\frac{17.3}{N}+\frac{64.9}{NS}+\frac{313.7}{Y}$
No. 30 Bliss Double-Roll Feed			$0.2006+\frac{4.5}{N}+\frac{56.1}{X}$	$0.1932+\frac{4.3}{N}+\frac{54.0}{X}+\frac{367.9}{Y}$	$0.1932+\frac{4.3}{N}+\frac{422.0}{Y}$
No. 20 Bliss	Hand Feed	Low Speed	$0.2471+\frac{18.8}{N}+\frac{55.4}{X}+\frac{66.6}{NS}$	$0.2406+\frac{18.3}{N}+\frac{54.0}{X}+\frac{64.9}{NS}+\frac{259.7}{Y}$	$0.2406+\frac{18.3}{N}+\frac{64.9}{NS}+\frac{313.7}{Y}$
No. 20 Bliss	Hand Feed	High Speed	$0.1736+\frac{18.8}{N}+\frac{55.4}{X}+\frac{66.6}{NS}$	$0.1691+\frac{18.3}{N}+\frac{54.0}{X}+\frac{64.9}{NS}+\frac{259.7}{Y}$	$0.1691+\frac{18.3}{N}+\frac{64.9}{NS}+\frac{313.7}{Y}$
No. 20 Bliss	Single-Roll Feed, Strip Reversed	Low Speed	$0.2487+\frac{22.3}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.2422+\frac{21.7}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.2422+\frac{21.7}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 20 Bliss	Single-Roll Feed, Strip Reversed	High Speed	$0.1748+\frac{22.3}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.1702+\frac{21.7}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.1702+\frac{21.7}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 20 Bliss	Single-Roll Feed, Strip Not Reversed	Low Speed	$0.2487+\frac{16.7}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.2422+\frac{16.3}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.2422+\frac{16.3}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 20 Bliss	Single-Roll Feed, Strip Not Reversed	High Speed	$0.1748+\frac{16.7}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.1702+\frac{16.3}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.1702+\frac{16.3}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 5 B. & J. Toggle		Hand Feed	$0.2795+\frac{16.7}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.2722+\frac{16.3}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.2722+\frac{16.3}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 5 B. & J. Toggle		Double-Roll Feed	$0.2795+\frac{13.4}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.2722+\frac{13.0}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.2722+\frac{13.0}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 5 B. & J. Toggle		Single-Roll Feed	$0.2795+\frac{16.7}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.2722+\frac{16.3}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.2722+\frac{16.3}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 73 Bliss Single-Roll Feed	Strip Reversed	Low Speed	$0.2543+\frac{22.3}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.2476+\frac{21.7}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.2476+\frac{21.7}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 73 Bliss Single-Roll Feed	Strip Reversed	High Speed	$0.1644+\frac{22.3}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.1600+\frac{21.7}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.1600+\frac{21.7}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 73 Bliss Single-Roll Feed	Strip Not Reversed	Low Speed	$0.2543+\frac{16.7}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.2476+\frac{16.3}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.2476+\frac{16.3}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 73 Bliss Single-Roll Feed	Strip Not Reversed	High Speed	$0.1644+\frac{16.7}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.1600+\frac{16.3}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.1600+\frac{16.3}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$
No. 2 Bliss Double-Roll Feed			$0.1598+\frac{7.8}{N}+\frac{55.8}{X}+\frac{67.1}{NS}$	$0.1556+\frac{7.6}{N}+\frac{54.4}{X}+\frac{65.3}{NS}+\frac{261.4}{Y}$	$0.1556+\frac{7.6}{N}+\frac{65.3}{NS}+\frac{315.8}{Y}$

N = No. of pieces in strip. X = No. of pieces pan holds. Y = No. of pieces in order. S = No. of strips placed on table at one time, or folded at one time, or tied at one time.

This necessitates a separate set of prices for M. F. coats.

In the case of double-breasted coats, the neck of the button on the right-hand side is wrapped with about ten turns of the linen thread before it is fastened and cut off. This is the regular method of fastening front buttons in this factory. Buttons on the left side, however, are wrapped only five or six times, hence the amount of time necessary to sew buttons on the left-hand side is less than that required to sew them on the right side. The buttons on the inside of the double-breasted coat are sewed in the same manner as the ones on the outside.

Unit Times. The unit times here shown are taken from at least 100 observations of each element in the two factories. In many cases it will be noticed that the element is repeated. This is due to the fact that the study carries through the complete operation of button-sewing on this one particular style of coat (see Table 5).

TABLE 5. TIME ELEMENTS ON BUTTON-SEWING

Element	*Description*	*Min.*
A.	Remove coat from hanger and place on lap with sleeve up	0.09
B.	Pick up threaded needle and take 2 stitches in sleeve to fasten thread	0.06
C.	Pick up button and string on thread	0.01
D.	Make first stitch from above, stick needle back through and draw thread	0.06
E.	Make second stitch from above, sticking through to next position	0.04
F.	Pick up button, string on thread	0.01
G.	Make first stitch from above, stick needle back through and draw thread	0.06
H.	Make second stitch from above, sticking through to next position	0.04
J.	Pick up button and string on thread	0.01
K.	Make first stitch from above, stick needle back through and draw thread	0.06
L.	Make second stitch from above, sticking back to under side of button	0.06
L_1.	Draw thread through	0.02
M.	Wrap thread around button two times	0.03
N.	Fasten thread by sticking needle through neck 3 times	0.05
O.	Pick up shears, cut thread, smooth out sleeve with hand, drop shears	0.01
P.	Turn coat to get other sleeve	0.07
	Elements B, C, D, E, F, G, H, J, K, L, L_1, M, N and O are then repeated for the second sleeve.	
P_1.	Turn coat with front up	0.10
A_2.	Pick up needle, make first stitch in cloth and pull through	0.03
B_2.	Make second stitch in cloth and pull through	0.02
C_2.	Pick up button, string on thread, and place in position	0.01
D_2.	Make first stitch from top, pull through, and return needle	0.08
E_2.	Make second stitch from top, pull through, and return needle	0.05
F_2.	Make third stitch from top, pull through, and return needle	0.06
G_2.	Make fourth stitch from top, pull through, and return needle	0.04
H_2.	Wrap thread about neck of button 10 times	0.11
J_2.	Stick needle through neck 3 times to fasten	0.10
K_2.	Pick up shears, cut thread, and cut remaining thread from needle, drop shears	0.08
A_3.	Pick up coat from lap and turn to neck	0.06
B_3.	Remove strap from inside pocket	0.02
C_3.	Trim ends of hanger	0.15
*D_3.	Place hanger in position on coat and sew one end	0.16
E_3.	Turn coat over and fasten on other side	0.05
F_3.	Pick up shears, cut thread, drop shears, knot thread	0.09

TABLE 5. TIME ELEMENTS ON BUTTON-SEWING [illegible]

Element	*Description*	*Min.*
G_3.	Lay hanger on [illegible]	[illegible]
*H_3.	Sew end	[illegible]
J_3.	Stick through and fasten [illegible] stitching [illegible]	[illegible]
K_3.	Pick up shears, cut thread, drop shears	[illegible]
*L_3.	Pick up pencil, get sleeve with tag, [illegible] and enter coat on slip	[illegible]
M_3.	Reach over to rack and get hanger	[illegible]
N_3.	Insert hanger in coat	[illegible]
O_3.	Hang coat on rack	[illegible]
	[illegible]	
*P_3.	Pick up linen thread (already cut), thread [illegible] and twist (3 buttons)	[illegible]
*Q.	Thread needle for sleeve buttons (6 buttons)	0.24
*R.	Thread needle for hanger strap (3 coats)	0.18

* Figures are total obtained from separate studies.

DERIVATION OF FORMULA—PLAIN SACK COATS

Let S = total number of buttons on each sleeve
" f = total number of buttons on front of coat
" x = piece price per coat

Then time required for min.:

Sleeve buttons $= A + 2(B + L_1 + M + N + O) + S(C + D + E) + P + P_1 = 0.66 + 0.14S$

Front $= f(A_2 + B_2 + C_2 + D_2 + E_2 + F_2 + G_2 + H_2 + J_2 + K_2) = 0.61f$

Hanger strap $= A_3 + B_3 + C_3 + D_3 + E_3 + F_3 + G_3 + H_3 + J_3 + K_3 + L_3 + M_3 + N_3 + O_3 = 1.77$

Thread needle for hanger strap per coat 0.06

Thread needle for buttons $0.04S + 0.17f$

Total $2.49 + 0.18S + 0.78f$

Allowing 20 per cent for rest and delay:

$$\text{Time allowed per coat (min.)} = 1.2(2.49 + 0.18S + 0.78f) = 2.988 + 0.216S + 0.936f$$

$$\text{No. coats per week} = \frac{44 \times 60}{2.988 + 0.216S + 0.936f}$$

The expected weekly earnings of the button-sewers in this plant was determined by the management at $27.22.

$$\text{Price per coat} = \frac{27.22}{\dfrac{44 \times 60}{2.988 + 0.216S + 0.936f}}$$

$$\text{Price per coat} = 0.03081 + 0.00223S + 0.00965f$$

With this formula it became possible to set piece prices for sewing buttons and hanger on plain sack coats of any style. The values for all possible combinations were worked out and tabulated as shown in Table 6.

DERIVATION OF FORMULA—DOUBLE-BREASTED COATS

Time required for:

Sleeve buttons $= A + 2(B + L_1 + M + N + O) + S(C + D + E) + P + P_1 = 0.66 + 0.14S$

Front buttons $= f(A_2 + B_2 + C_2 + D_2 + E_2 + F_2 + G_2 + J_2 + K_2) + \frac{f-1}{2} H_2 + \frac{f+1}{2}(H) = -0.08 + 0.58f$

Hanger $= A_3 + B_3 + C_3 + D_3 + E_3 + F_3 + G_3 + H_3 + J_3 + K_3 + L_3 + M_3 + N_3 + O_3 = 1.77$

Thread needles for hangers per coat 0.06

Thread needles for buttons per coat $0.04S + 0.17f$

Total $2.41 + 0.18S + 0.75f$

Allowing 20 per cent for rest and delay:

$$\text{Time allowed per coat } (min.) = +1.2\ (2.41+0.18S+0.75f = 2.892+0.216S+0.9f)$$

$$\text{No. coats per week} = \frac{44\times 60}{2.892+0.216S+0.9f}$$

$$\text{Price per coat} = \frac{27.22}{\dfrac{44\times 60}{2.892+0.216S+0.9f}} = 0.0298+0.00223S+0.00928f$$

Knowing the number of sleeves and front buttons on any double-breasted coat this formula gave the piece price to be paid for sewing on the buttons and hanger. The values for all possible combinations of S and f are shown in Table 6 in tabular form.

The fact that M. F. sack coats required each individual sleeve button to be individually sewed on necessitated a separate series of rates. The unit times obtained from the other studies were sufficient to determine these formulae without additional studies.

M. F. SACK COATS

Time required for:		
Sleeve buttons $= A+P+P_1+S\ (B+C+D+L+M+N+O)$	$=0.26+0.34S$	
Front buttons $=$		$0.61f$
Hanger strap $=$	1.77	
Thread needle for hanger strap (per coat)	0.06	
Thread needle for buttons		$0.04S+0.17f$
Total		$2.09+0.38S+0.78f$

Allowing 20 per cent for rest and delay:

$$\text{Time per coat} = 1.2\ (2.09+0.38S+0.78f) = 2.508+0.456S+0.936f$$

$$\text{No. coats per week} = \frac{44\times 60}{2.508+0.456S+0.936f}$$

$$\text{Price per coat} = \frac{27.22}{\dfrac{44\times 60}{2.508+0.456S+0.936f}} = 0.02586+0.0047S+0.00965f$$

The values for this equation per 100 coats for all combinations of S and f are shown in Table 6.

M. F. DOUBLE-BREASTED COATS

Time required for:			
Sleeve buttons (from M. F. sacks) $=$	0.26	$+0.34S$	
Front buttons (from D. B. sacks) $=$	-0.08		$+0.58f$
Hanger (from D. B. sacks) $=$	1.77		
Thread needles (from D. B. sacks) $=$	0.06	$+0.04S$	$+0.17f$
Total	2.01	$0.38S$	$0.75f$

Allowing 20 per cent for rest and delay:

$$\text{Time per coat} = 1.2\ (2.01+0.38S+0.75f) = 2.412+0.456S+0.9f$$

$$\text{No. coats per week} = \frac{44\times 60}{2.412+0.456S+0.9f}$$

$$\text{Price per coat} = \frac{27.22}{\dfrac{44\times 60}{2.412+0.456S+0.9f}}$$

$$\text{Price per coat} = 0.02487+0.0047S+0.00926f$$

The values for this equation per 100 coats for all combinations of S and f are shown in Table 6.

TABLE 6. PIECE PRICES PER 100 COATS

REGULAR SACK COATS

PLAIN SACK COATS

No. Buttons on Front	No. Buttons on Sleeves: 0	2	4	6	8
1	\$4.05	\$4.49	\$4.94	\$5.38	\$5.83
2	5.01	5.46	5.90	6.35	6.80
3	5.98	6.42	6.87	7.31	7.76
4	6.94	7.39	7.83	8.28	8.73

DOUBLE-BREASTED COATS

No. Buttons on Front	No. Buttons on Sleeves: 0	2	4	6	8
3	\$ 5.77	\$ 6.21	\$ 6.66	\$ 7.10	\$ 7.55
5	7.62	8.07	8.51	8.96	9.41
7	9.48	9.92	10.37	10.82	11.26
9	11.33	11.78	12.23	12.67	13.12

M. F. COATS

PLAIN SACK COATS				DOUBLE-BREASTED COATS			
No. Buttons on Front	No. Buttons on Sleeves			No. Buttons on Front	No. Buttons on Sleeves		
	4	6	8		4	6	8
1	\$5.43	\$6.37	\$7.31	3	\$7.15	\$8.09	\$9.03
2	6.40	7.34	8.28	5	9.00	9.95	10.89
3	7.36	8.30	9.24	7	10.86	11.80	12.74
4	8.33	9.27	10.21	9	12.72	13.66	14.60

NOTE:
1. M. F. coats have each sleeve button fastened individually. When they have 0 and 2 buttons on sleeves the prices are the same as for regular sack coats.
2. The button sewed on the inside of double-breasted coats is counted as a front button.
3. The total number of buttons on the 2 sleeves are used in the table.

These formulae have been used with success and satisfaction to both employer and employee. They filled a long-felt want in that they placed all the piece prices on an equitable basis so that the workers could earn the same wages regardless of the style of coat on which they were working. Prior to the introduction of these formulae the piece prices were set by someone's guess, with the result that on some styles the operators could earn a good wage and on other styles they could not earn nearly so much. This was the cause of much dissatisfaction among the workers and particularly in some seasons when the styles prevailed in which the poorer rates predominated.

The above analysis is typical of a study that can be profitably made in almost every industry where repetitive or similar processes are in use. The greater the similarity between jobs of somewhat different natures, the larger the opportunity that exists to achieve accurate results at merely nominal expense.

Industrial Office Building Maintenance

By WALLACE CLARK[1]

Consulting Management Engineer

Class Number
651.1:658 Office Buildings. Management.
658.9:651.1 Management. Office Buildings.

THE maintenance of an office building, whether it is located alongside the manufacturing plant or in a large city far away from the shop, is a more complex and difficult task than is apparent to the casual observer. To operate and maintain successfully a large office building with its equipment, furniture, and appliances requires a greater variety of knowledge and experience than is usually possessed by one who has spent his business life in an office. The more shop experience he has had, the better he will be fitted for this task. It is necessary to be familiar with the city fire and building regulations and the ordinances or police regulations covering the use of the sidewalks and streets; to know a good deal about all of the building trades, particularly carpentry, plumbing, painting, and plastering; to know how to run a boiler-room, how to keep pumps, motors, elevators, and other kinds of machinery always ready for use; to be familiar with problems of lighting and electric wiring, and with the latest and most economical methods of cleaning and maintaining floors, windows, furniture, and office appliances.

Hiring a few janitors to sweep, dust, and occasionally clean windows will not keep an industrial office building in good condition. Planning, scheduling, inspection, and repairs are as necessary in the work of maintaining this part of the plant as they are in shop operations. Quick and accurate performance of tasks by office employees, conservation of the investment in the building and its equipment, and, often, a favorable impression on the public are the results of proper upkeep methods.

The proper maintenance of an office is important for these reasons:

1. To provide good working conditions.
2. To conserve the investment in the building and its equipment.
3. To convey a satisfactory impression to the public.

The work of maintenance of an office building is usually delegated to a superintendent of the building or the office manager. It is the duty of this person to train the various members of his staff in the methods of doing their work, and to render the necessary service to those who occupy the building. His staff is varied, depending on the size and character of the building and its equipment. He may have a house carpenter, a painter, an electrician, an engineer for the boiler-room, firemen, elevator operators, janitors, porters, scrub women, and window cleaners.

In order to keep the furniture and equipment of an office in good condition, it must be regularly inspected. Defects in desks, tables, chairs, and files can be discovered by a careful, although comparatively rapid, inspection at monthly intervals. All employees should also be requested to report any breakage or defect to the person who inspects furniture.

At frequent intervals someone with authority should go through the office and see that tops of files, bookcases, and cupboards are kept free from papers. If such papers must be kept in the office, filing space should be provided so that the information contained in the papers will be easily available; but if the papers are consulted only occasionally, they can be placed in a storage room. (Figs. 1 and 2.)

If there is a sprinkler equipment in the office, it should be carefully inspected once a month to see that all valves are tied open, that no heads are leaking, and that there is the proper amount of air pressure in the tank.

It is also necessary to inspect regularly all water tanks to prevent leakage and to see that valves of fire tanks are open. Fire hose must be in a proper condition for use, and fire extinguishers recharged at definite intervals.

If there is a night watchman, his reports must be checked, and, when irregular, the reasons must be investigated. Storage batteries must be tested and filled at regular intervals. Electric, gas, and water meters must be read and checked with the monthly bills.

In a large office it is sometimes found more advantageous to keep a house carpenter on the premises than to call in an outside carpenter at frequent intervals, because in the latter case it is difficult to secure a carpenter when wanted, and it is even harder to find one who will always do good work.

The amount of work for the house carpenter will not often be regular, that is, there will be some weeks when he has more than he can do. At such times, the comparative importance of his various tasks must be investigated and he must be told the order in which they are to be done. The carpenter should not be left to decide for himself the importance of his work, for he is not familiar with the business as a whole. The office manager or one of his assistants can do this most satisfactorily. One good method of handling this is for every request for carpenter work to go to the office manager, who will determine the importance of the work and write on the memorandum the date on which he would like it completed. When the carpenter receives these memoranda, he does the work in the sequence indicated by the dates wanted.

[1] *Author of "The Gantt Chart."*

Another method is for the office manager to go over at the end of each week all the work ahead of the carpenter and give him an order of work for the following week similar in form to this:

HOUSE CARPENTER

Order of Work for the Week Ending April 23

1. Make table for advertising department.
2. Repair linoleum under Mr. ......'s desk.
3. Crate table for New York office.
4. Repair vertical file in treasurer's department.

FIG. 1 APPEARANCE OF OFFICE MARRED BY ACCUMULATED PAPERS

5. Make three boxes for machines, foreign department.
6. Repair desk drawer in sales department.
7. Repair desk in controller's department.
8. Repair gate, traffic department.
9. Fix door in girls' locker-room, fourth floor.
10. Hang picture in demonstration room.

The written instructions to this same house carpenter covering his work in general are as follows:

INSTRUCTIONS TO HOUSE CARPENTER

Hours:
8 A M to 5 P M week days. 8 A M to 12:30 P M Saturdays.

Oiling Chair Casters:
Oil all chair casters, taking one floor each week.

General Carpenter Work:
Orders will be sent to you by the office manager. Do not accept orders from any other source. At the end of each week bring to the office manager all your uncompleted orders and get from him an "order of work" for the following week.

Ordering Supplies:
Order supplies needed on purchase requisition and submit to the office manager for approval. Do not buy articles for cash except when absolutely necessary, at which time the office manager will O K cash voucher.

In large offices a painter is often employed whose duty it is to inspect all painted or varnished surfaces and keep them in proper condition. The following instructions to a painter will give an idea of the kind of work he might be expected to do:

INSTRUCTIONS TO PAINTER

Working Hours:
8 A M to 6 P M.

Inspecting and Cleaning Furniture:
Every morning starting at 8 o'clock make a complete inspection of all furniture, taking one floor each day. If you find any furniture with small ink spots, scratches, or any other minor defects, you can probably remedy the same at the time of making inspection. If a piece of furniture is in very bad condition, confer with the office manager and he will advise you what to do.

The best plan to follow each day is to make an inspection of all desks and chairs first so that you will be through with them when the people using them start in to work. The filing cabinets, bookcases, etc., can be gone over while the people are working.

In cleaning desks and chairs follow the instructions furnished you for this purpose.

Inspecting and Cleaning Partitions and Railings, Etc.:
Starting at 11 o'clock each day, make a complete inspection of all partitions, railings, bases of columns, baseboards, elevator doors, stairway doors, window frames, radiators, piping and plaster surfaces. If you find any part of the above in bad condition, such as partitions needing to be oiled and rubbed down, railings scrubbed, plaster cracked or doorways dirty, if it will not take too long, take care of same at time of making inspection. If you find any defect that will take any great length of time or that you are unable to take care of yourself, notify the office manager and he will give you instructions regarding the same.

Special Work:
All special work given to you is to be done during the afternoon after you have made your inspections. If there is any rush job that will affect your schedule of inspection in any way, you will be notified to this effect and other arrangements made for the inspection.

If anybody requests you to do any work for him, refer him to the office manager. All of your orders are to be taken directly from him.

Ordering Supplies:
When you are in need of any supplies, write them in full on the order forms furnished you and hand to the office manager.

The employment of a house electrician and machinist is also economical in a large office. It is his duty to look after all electric wiring, to keep clocks regulated, to install and maintain buzzers, to inspect and repair motors and machinery connected with elevators, electric fans, and any other motors, pumps, machines, or appliances in the office building. Either the house electrician or the elevator operator will grease the sheaves of the elevator and the guides, unless they are automatically greased.

It is worth while to write out instructions covering the work of a house electrician, possibly in the following form:

Cleaning Elevator Machinery:

Open main switch before cleaning or oiling any part of the machinery.

Use the hand bellows to blow dust from parts of machinery not easily reached.

Wipe all other parts clean with cotton rags or waste.

See that automatic feed rings in motor bearings turn freely and keep oil chamber sufficiently full so that oil rings will dip into it.

Lubricate the drum or sheave bearings every day.

Lubricate governor bearings and gears twice each week.

Sandpaper the commutator every day to keep smooth. Use fine sandpaper.

Examine bolts between drum neck and drum or driving sheave and tighten when necessary.

Oil sparingly the pins and moving parts of all switches and see that all nuts, lock nuts, and cotter pins are in place and secure.

Once a week remove cover of car switch and see that contacts are in good condition and properly lubricated.

Keep all parts of switch clean to prevent short circuits.

It is obvious that the important feature in connection with elevators is to keep them running. If there is a house electrician, it is his duty to keep the motors and elevator machinery in condition to run, and it is worth while to pay him a bonus at the end of a month for each elevator which has been ready to run at all times during office hours.

If there are five or more elevators, a bonus may well amount to 20 per cent of the electrician's monthly wages. In one case a house electrician is paid $5 for each elevator which has not been out of commission during the month. If all of the six elevators under his charge have had a perfect score, he receives $30.

This amount is sufficient to make his inspection very thorough so that he can foresee mechanical and electrical troubles and make repairs or adjustments outside of office hours.

A bonus, sometimes amounting to 10 per cent, may also be paid to each operator if he has not been late or absent at any time during the month. Operators must be thoroughly familiar with the elevator machinery so that they can avoid accidents and take prompt action if an accident should occur.

All elevators should be covered by accident insurance. The periodical inspections of the insurance company will usually be sufficient to prevent any accident due to the condition of the cables.

In order to get the best results from the electric current used it is necessary to keep the surfaces from which light is to be reflected clean and white, and the glass through which light is to pass free from dust. Ceilings should be painted or calcimined frequently because they lose their whiteness with age. Fixtures should be wiped with a dry rag once a week in the usual city and thoroughly washed at least twice a year.

To maintain lighting fixtures properly is principally a matter of scheduling the work. Experiment will indicate the amount of time required to clean the fixtures on each floor and the frequency with which they must be cleaned.

In order to lengthen the life of furniture, wooden partitions and railings, the surfaces must be maintained as nearly as possible in their original condition. The following treatment at intervals of about two months will maintain wooden surfaces in proper condition, unless there is an unusual amount of dampness, dust, or soot in the air, in which case they must be cleaned more frequently.

FIG. 2 STORING PAPERS IN DESKS AND FILES IMPROVES OFFICE APPEARANCE

Varnished Surfaces

Material Needed for Removing Dirt and Ink

Good cleaning oil and cheese-cloth.

Method

Dampen a piece of cheese-cloth with the oil.

Rub the surface well.

Wipe off excess oil with dry cheese-cloth.

Linoleum tops of desks should be cleaned more frequently, at least once a month; and tops of counters possibly every day. The following method has proved most satisfactory.

Linoleum Tops of Desks and Counters

Material Needed for Removing Dirt and Ink

Fine sandpaper. (No. 0 and No. 00).

Bon Ami.

Butchers' wax.

Linseed oil.

Method of Removing Dirt

Dampen cheese-cloth with linseed oil.

Rub hard.

Dry with clean cheese-cloth.

Apply a little butchers' wax with cheese-cloth.

Rub thoroughly.

Method of Removing Fresh Ink
- Dampen a cloth with water.
- Apply a little Bon Ami.
- Dry with clean cheese-cloth.
- Rub with a little linseed oil and butchers' wax.

Method of Removing Hardened Ink
- Dampen a cloth with water.
- Apply a little Bon Ami and sandpaper alternately.
- Rub with a little linseed oil and butchers' wax.

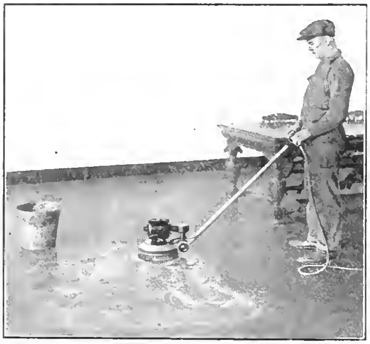


FIG. 3 THE FIRST STEP IN RENEWING AN OLD LINOLEUM FLOOR IS SCRUBBING[2]

Pour on the linoleum a small quantity of lukewarm suds, made with an approved soap, and run the electric machine slowly over the floor until the dirt has been thoroughly loosened.

Method of Removing Deep Scratches
- Soften linoleum by rubbing vaseline into scratch and allow to stand over night.
- Apply butchers' wax with cheese-cloth.
- Rub thoroughly.
- If scratch is still noticeable, use sandpaper and follow with butchers' wax and a thorough rubbing.

Casters on chairs should be oiled regularly once a month—about two drops on each caster. If this is not done the casters will stick and then wear on one side, which will prevent them from turning easily and cause them to mar the floor.

FIG. 4 THE SECOND STEP IS TO TAKE UP THE DIRTY WATER AFTER SCRUBBING WITH THE MACHINE IS FINISHED

A metal floor pan and rubber squeegee are most satisfactory, although an ordinary cotton mop can be used.

[2] Figs. 3, 4, 5, 6 and 7 by courtesy of the Armstrong Cork Co.

If chairs have cane seats, heavy webbing stretched taut under the seat will prevent the cane from sagging. Chairs should be re-caned before they are likely to injure clothing.

Conditions of health, appearance, and safety make it necessary to keep floors clean. In the usual office the floors are swept daily, either after working hours at night or before the office opens in the morning. In sweeping office floors, a push-broom is better than the usual house broom, because the former covers more ground with each stroke. These brooms come in various widths; wide brooms are better for hallways, aisles, and spaces unoccupied by furniture; and narrower brooms are easier to get around chairs and the legs of desks and files. A broom 18 in. wide is an average width for occupied floor areas. For corridors and sidewalks a 36-in. broom is most convenient.

Sweeping floors, however, does not remove all the dirt and it is necessary at frequent intervals to give them a more thorough cleaning. The methods of treatment of hard wood and linoleum floors are very much

FIG. 5 THE THIRD STEP IS WAXING

Paste wax may be used but liquid wax is easier to apply. On a large floor, pour the wax into a bucket and immerse a clean cotton mop in it. Mop the linoleum first one direction, then the other, until a thin coating of wax has been spread over the whole area.

the same, and, since linoleum is more satisfactory for offices and more generally used, that kind of floor covering will be dealt with here.

The three principal methods of treating linoleum beside sweeping are:

1. Scrubbing with soap and water.
2. Applying varnish or shellac.
3. Applying a wax mixture.

In scrubbing floors, whether it be done with a hand-brush, a rag, a mop, or an electric machine, success depends principally on the amount of clean water used. Unfortunately, in some cases, scrubbing accomplishes nothing but a more equal distribution of dirt. In order to get the dirt off the floor, it must be gotten into the wet mop or rag and then out of the mop. The latter is done by wringing the dirty water out of the mop and dipping the mop into clean water before putting it back on the floor. The cleaning of the floor, therefore, is in proportion to the clear water used in rinsing the mop.

Possibly the greatest difficulty in connection with scrubbing offices in large cities is to secure men or women with sufficient intelligence to do this work properly without an unusual amount of supervision. The work itself is not pleasant and good workers can seldom be secured even if high wages are paid.

Soap and washing powders are injurious to both linoleum and wood floors and should, therefore, be

FIG. 6 FOURTH STEP IS POLISHING THE WAX

After the wax has dried, about 20 min., put the polishing brush on the machine and run over the floor slowly, first one direction, then the other. This brushes the wax into the linoleum and starts the polish. To finish, use the polishing pad.

used sparingly, either a very small amount whenever the floors are scrubbed or a stronger solution at long intervals. It is wise to put a little disinfectant in all water used for scrubbing office floors and a larger amount for cleaning washrooms and toilets.

This first method of cleaning floors, that is, scrubbing with soap and water, is the least satisfactory because it requires a great deal of labor and, for that reason, is the most expensive method. Soap and water affect the gums in linoleum and dry them out, and the result is that the linoleum cracks and wears and its life is shortened.

The application of shellac or varnish forms a coating over the linoleum and protects it from water and from wear, and, therefore, lengthens its life. The disadvantages of varnish are that it forms a coating which is harder and less flexible than the linoleum itself and eventually causes it to crack; varnish takes some time to dry and, if not thoroughly dried, heat and moisture will cause it to stick.

The third method, the application of a wax mixture, is by far the most satisfactory plan. Wax protects the linoleum from water and from wear, preserves its resilient qualities, dries in 20 min., does not stick, and gives the linoleum a rich, polished appearance.

This method (see Figs. 3 to 7) greatly reduces the labor and, consequently, the cost of maintaining a linoleum floor, because it obviates the necessity of scrubbing or mopping each day. However, the improved appearance of the floor is even more noteworthy than the money saving. Under good conditions the cost of waxing linoleum varies from 10 to 13 cents per sq. yd.

The only satisfactory method of cleaning office rugs is by means of a vacuum cleaner. That is also the most economical method of cleaning elevator pits, basements, storerooms, and shelves of all kinds. A sufficiently powerful machine should be used in order to allow rapid cleaning.

In cleaning the glass in windows and partitions, it is necessary not only to get the dirt off the glass, but the glass must also be polished. It is not difficult to get windows cleaned properly, for the operation itself is simple, there are plenty of men who know how to do it, and even a casual inspection will show how well the cleaning has been done. The usual difficulty in connection with window cleaning is to get it done frequently or at regular intervals, and, for that reason, a schedule must be worked out and maintained.

If the work is to be done by professional window cleaners, a contract in the form of a schedule is made, and then it becomes the task of someone in the office to inspect the windows to see that they are properly cleaned and that the schedule called for in the contract is lived up to.

If the window cleaning is to be done by men employed by the office for that purpose, it is necessary to establish a schedule which will keep the windows

FIG. 7 DAILY CARE

The janitor can keep a linoleum floor that has been waxed and polished clean and bright by going over it every evening with a fine, hair broom. It may be necessary to repolish the main traveled areas every week or so, but a complete rewaxing and repolishing should be necessary only three or four times a year.

sufficiently clean under normal conditions. The task then becomes one of maintaining that schedule at as low a cost as possible.

If the building is large, it is worth while to study the various methods of window cleaning, select the best method, teach the workmen how to use that method, establish a task and pay the workmen a bonus. The following are extracts from instructions given window cleaners in the office of a large corporation:

At the beginning of each week, a schedule will be given you showing the order in which windows and glass partitions are to be cleaned. The time you should take on each individual job will be given on this sheet.

When you start a job, note the time under the heading "Began" on this schedule. When finished, note time under heading "Finished," also fill in the number of windows cleaned under heading "Work Completed." (See Fig. 8.)

Do your work in accordance with these instructions:

Second Floor Windows

(*a*) Remove ventilator; soak rag and wring out.
(*b*) Apply water, rub with chamois, rub and polish with dry cloth lower left 4 panels.
(*c*) B to lower right 4 panes.
(*d*) Raise sashes, pull down uppers; wet rag and wring out.
(*e*) B to upper left 4 panes.
(*f*) B to upper right 4 panes.
(*g*) Wet rag and wring out; go outside and attach belt.

Week ending ....

.... (Name)

To be Cleaned	Time per Window	Began	Finished	Work Completed

Form No. ...... WEEKLY SCHEDULE FOR WINDOW CLEANER

FIG. 8 SCHEDULE OF WORK FOR WINDOW CLEANER

(*h*) B to upper small sashes (2 panes).
(*i*) B to lower small sashes (2 panes).
(*j*) Move to center and attach belt.
(*k*) B to upper center (4 panes).
(*l*) Come in, wet rag and return.
(*m*) B to lower center 4 panes.
(*n*) Move to small window and attach belt.
(*o*) B to upper 2 panes.
(*p*) B to lower 2 panes.
(*q*) Come in, clean, and replace ventilator.

If you complete 9 hours' work as shown on the schedule in one working day, you will be paid at the rate of $4.50 per day. If you finish 9 hours' work in less than 9 hours, you will be paid $4.50 plus 50 cents per hour for the remainder of the day, if the work done during that time is finished on schedule time. If you do not finish work on schedule time, you will be paid 40 cents per hour.

If you are taken away from window cleaning to any other work, you will be paid 50 cents per hour. In case of sickness and on holidays you will be paid 40 cents per hour.

Your work will be inspected daily. If it is found that any of the windows are not up to the standard, you will be asked to clean them again. No payment will be made for time spent in doing work over.

In this case the best method of cleaning the windows was worked out and taught to the cleaner, and he was paid according to the amount of work he did, that is, he was guaranteed an hourly rate of 40 cents, but, if he accomplished the tasks set for him, he would receive 50 cents per hour and also double pay for whatever time he saved on those tasks. The result was a considerable reduction in expense and much cleaner windows.

Walls should be painted so that they can be washed with soap and water whenever they need it. They show dirt particularly where they are touched or rubbed against, i. e., up to a height of five feet. Doors and window frames need to be washed more frequently.

If there are sprinkler pipes on the ceilings, they should be dusted off with a brush at regular but infrequent intervals.

Various methods are used in disposing of waste paper. At the end of the day, before sweeping begins, a truck with rubber tires, which will not injure floor coverings, may be wheeled through the office and all waste baskets carried to it and emptied into it, or a bag with a hoop sewed in the top to keep it open may be carried from desk to desk and waste baskets emptied into the bag. On account of the danger of fire, waste paper should not be stored loose in an office building. It should either be disposed of immediately or baled on the premises. Baling increases the sales price.

The employees engaged in the maintenance of an office building usually have a greater variety of work to look after than the average employee, and it is, therefore, particularly important that their duties should be clearly outlined and their responsibilities definitely fixed. They should receive instructions as to what to do from one person only and should be held responsible for results by that person.

Schedules and time-tables with daily or weekly reports provide an effective means for the control of employees engaged in maintenance work. In Fig. 9 a schedule is shown for seven men who compose the night janitor force of a well-known corporation.

The person who is responsible for the work of a department of this kind will stress maintenance rather than repairs, that is, he will endeavor to maintain the

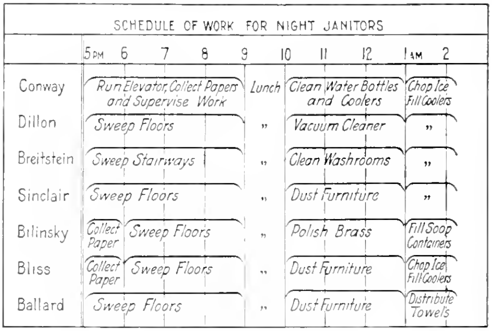


FIG. 9 SCHEDULE OF WORK FOR NIGHT JANITORS

building and equipment in their original condition and prevent deterioration so as to make the task of repairing as light as possible and also to lengthen the life of both the building and its equipment.

No matter how large or how small the office may be, the manager will find it worth while to study the needs of his office, to provide the best equipment consistent with economy, and to see that that equipment is properly maintained and used to the best possible advantage. The more attention he gives to this subject, the more successful he will be in getting the necessary work of the office done accurately and on time.

Will Profit-Sharing Bring Management-Sharing?

Among 15 Typical Profit-Sharing Plans Adopted Since 1919, Two, the Dix and Dennison, Have Management-Sharing Features

By JOSEPH MAYER

[illegible] Economist

THE year 1923 had hardly made a constitutionally sober appearance upon the stage of international and industrial perplexity bequeathed by the World War, when leading dailies the country over gave considerable space to the unique profit-sharing plan of Henry A. Dix, millionaire clothing manufacturer. Headliners told us that a million-dollar plant had been turned over to the workers, to be paid for out of future profits. Mr. Dix was quoted as saying that: ". . . those who give their lives to building up a business for another man should have some share beyond that of mere wages in the concern which they helped to create." A leading metropolitan daily observed editorially that if more employers were like-minded the solution of the problem of labor unrest would be in sight.

Still more recently, George Eastman, President of the Eastman Kodak Company, in commenting upon the plan of profit-sharing in vogue in his concern, indicated his belief that "the solution of the employer-employee problem lies in this direction."

The fact that Mr. Dix and Mr. Eastman and a few others have recently unburdened themselves regarding profit-sharing is no necessary indication of a general renewal of interest in the subject among business men in this country. But that these are not isolated expressions or developments is readily apparent from a general review of what has been happening along profit-sharing lines since the war.

> **Opinion is divided as to the value of profit-sharing. Critics urge two major difficulties. The first is the deferred wage-payment fallacy: the second that sooner or later the worker considers his profit payment as an inherent right.**
>
> **Possibly from a recognition of these difficulties two tendencies have shown themselves since 1919: Stock purchase opportunities instead of cash payments, and combined profit-sharing and management sharing. The weight of opinion seems to be against the latter plan.**

Growing Interest in Profit-Sharing

In January, 1919, John N. Willys, President of the Willys-Overland Company, announced that, after a fair return on investment and just compensation to labor, he intended for the future to divide profits with his 10,000 employees on a fifty-fifty basis. It was shortly afterwards that George Eastman announced that the annual profit-sharing dividend had been distributed to his employees, that this amounted close to one million dollars, and that the plan would be continued with new features added. About the same time the great shoe works of Endicott, Johnson and Company, capitalized at $36,000,000, and with an output of 75,000 pairs of shoes per day, announced a fifty-fifty profit-sharing plan somewhat similar to that of the Willys-Overland Company, to apply to 12,000 workers. During the same year the American Sash and Door Company, the Simmons Company of Wisconsin, the Hilo Varnish Company, and the National Sugar Manufacturing Company established profit-sharing plans.

Even greater activity occurred during 1920 and 1921, the International Harvester Company, the National Cash Register Company and the United States Steel Corporation being among the outstanding concerns making announcements. The plan of the International Harvester Company, affecting 40,000 employees and setting aside $60,000,000 of stock in the corporation to be distributed under the scheme, was heralded to be without parallel in size and scope in the annals of American business. The company indicated that it expected to gain materially in increased output under the plan, in which the workers share ahead of men on the executive and office staffs.

This profit-sharing activity among big business concerns in the United States since the war finds a parallel in Great Britain. Nor are only large concerns affected. Towards the end of 1920, *The Typothetæ Bulletin* contained an analysis of 138 profit-sharing and bonus plans found in the city of Chicago alone. During the same year the writer made a comprehensive study of profit-sharing in industrial establishments in the United States[1] which showed a decided renewal of interest since the war. But it also indicated that American business men are now endeavoring to avoid certain difficulties which in the past had wrecked many a promising profit-sharing plan. Whether all past difficulties can be overcome, however, is one of the questions the present article will raise.

[1] Published by the National Industrial Conference Board as Research Report No. 29, June 1920.

Better esprit-de-corps, morale, and a stabilization of the working force, are what employers expect in return for the outlays involved in profit-sharing. Such were the main objectives indicated by employers interrogated in connection with the above-mentioned study of profit-sharing plans made by the writer, and such have been the objectives aimed at in plans inaugurated since. Although other aims are often also indicated, the idea of securing the workers' co-operation and loyalty runs through every plan the writer has encountered. The following are typical expressions of purpose: "to provide an incentive to better work;" "to increase the workers' interest in the success of the business;" "to provide a new motive for promoting the prosperity of the company;" and the like.

Opinion Divided Regarding Value

It is quite clear what the employer is after in introducing profit-sharing plans and why the present long period of after-the-war reconstruction should be a time of renewed interest. But many intelligent people feel that the employer is deluding himself with his expectations, that in the end he is stirring up more difficulty than he is now hoping to overcome.

One reason for the difference of opinion concerning merits or demerits arises out of a loose use of the term "profit-sharing." Even our libraries classify under this heading material which has no business there. This is not the librarian's fault. It is, in a measure, the fault of those who hold out to their workers a share in profits, as an incentive to better workmanship, but so arrange the details of the plan that no real and direct relation to profits is involved. On the other hand, even among those who have studied the subject most carefully, there is considerable divergence of view as to the value of profit-sharing. Most of the opinions are unfavorable, some authorities going so far as to say that allowing the worker to share in profits opens up a long avenue of troubles much more serious than those it is sought to allay.

The investigation made by the writer three years ago was sponsored by a large group of manufacturers in this country. The results indicated that "profit-sharing is no panacea and cannot be offered as a solution of the wage problem." But some prominent business men are quite evidently in disagreement with this conclusion and are willing to back up their contrary conviction with dollars and cents. The renewed interest, therefore, entitles the subject to serious consideration from a new angle, although it may perhaps be that the prominent manufacturer speaking for publication and picturing his profit-sharing plan in roseate coloring, sees an entirely different significance in its successful operation than do his workers or disinterested business analysts.

Since there is a variety of meanings wrapped up in the term "profit-sharing," it is necessary to distinguish clearly the "true" type from other varieties. Certain allied forms, as stock purchase plans, are important, but they should not be confused with true profit-sharing for the reason that whatever pitfalls lurk in the profit-sharing idea cannot be understood unless the idea itself is stripped of any related notions which modify it.

True profit-sharing implies that the extra compensation handed out to the workers varies directly, and rises or falls proportionately, with an increase or decrease in the amount of profits realized. To hand out a wage bonus at the end of a lean year to spur effort during the following one is not true profit-sharing, unless the relationship of wage bonus to profits is as just stated; similarly, with stock purchase and savings-sharing plans. It is not enough that there be *some* relationship to profits, no matter how intangible. The relationship must be definite and precise. A differentiation must also be made between that limited form of profit-sharing which applies to executive employees only and the "true" type which applies to the rank and file.

The outstanding characteristics of true profit-sharing are, first, that the employer engages to distribute to his workers an actual share of net profits (the percentage of which is fixed in advance) and, secondly, that the plan applies to the average workman. The actual percentage of the workers' participation is fixed in advance, so that he may feel that the size of his share will depend so far as possible on how profitable he, himself, helps to make the enterprise, and that no juggling of percentages will be resorted to after profits have accrued at the end of the year.

Limited profit-sharing conforms to this idea except that it does not reach down to the average workman. Wage bonuses are decided upon arbitrarily and bear no predetermined relation to profits. Savings-sharing plans distribute to the workers a portion of the savings effected in cost of production by increased efficiency on their part. Stock purchase plans emphasize the importance of thrift and are primarily a matter of the employee investing his savings in shares of the company's stock.

Obviously all these allied schemes are in some way indirectly connected with profits, but they do not focus the average workman's attention on the conception that the share of profits coming to him is dependent directly upon *how profitable he, himself, helps to make the enterprise*, which incentive is recognized by friend and foe alike as the supreme motivating force behind true profit-sharing plans.

This conception of true profit-sharing is not a theory but an actual working reality. In speaking of firms that have profit-sharing plans and in reviewing the present revival of activity, the writer has in the preceding sections confined himself entirely to the true type, although some of the concerns mentioned have other plans in force alongside of their true profit-sharing plans, notably stock purchase plans and wage bonuses. So much for what the chief incentive behind true profit-sharing amounts to. It focuses the worker's attention on the idea that by greater co-operation he can increase profits and thus the share coming to him.

Two Difficulties

Approaching the question of the pitfalls lurking in the profit-sharing idea, we find that past experience indicates two important difficulties to be overcome.

The first one might be called the deferred wage-payment fallacy. Before the war, profit-sharing distributions were made mainly in cash. Up to the beginning of 1920, out of 37 true profit-sharing plans found by the writer to be in active use and distributing the profit-share directly to the workers, 26 made payments exclusively in cash, 4 made payments partly in cash and partly in stock, and only 7 made payments wholly in stock.

Where payments are chiefly in cash, the worker comes to regard them as deferred wages legitimately due him anyhow. For example, it has worked out time and again that an employee receiving, say, a wage of \$1800 a year and an additional \$200 at the end of a particular year as his share of profits, considers himself as receiving a wage of \$2000. On this basis he makes his expenditures or borrows money during the following year, and it sometimes happens that the profit-share is spent before it is received. It is easy to see how this comes to be a source of dissatisfaction if the profit-sharing distribution, as it must, rises and falls proportionately with the profits realized. If the workman is counting on getting \$200 at the end of the year and gets only \$150, or nothing at all at the end of a particularly dull year, and regards this money as legitimately due him anyhow, he feels that he is being "docked" and consequently becomes dissatisfied. The profit-sharing plan intended to create an added incentive and loyalty results, under such conditions, in still greater unrest. This has been the experience of many concerns attempting profit-sharing and making payments in the form of cash.

The second difficulty revolves about the eventuality that, when a worker has become accustomed to participate in profits, he sooner or later concludes that he has an inherent right to the profit distributions that come to him. This is particularly the effect where radical agitators propagate that idea anyway, and where no effort is made by the management to prevent the workingman from falling into this attitude.

Where the worker gets the idea that he has a right to share in profits, it is easy to understand why, after a year or two of a profit-sharing plan's operation, it ceases to provide the very stimulus it was inaugurated to produce. Where an employee thinks he has an inherent right to something he is getting, where is his incentive to additional zeal? He may even come to feel, and often does, that, previous to the establishment of an existing profit-sharing plan, he has been cheated out of his just due, or that he is entitled to a larger share in the profits than he is receiving.

Workers' Rights to Share in Profits

There is no conception given more currency today, none more widespread and none more intimately associated with labor unrest, than the idea that the worker as a wage-earner has an inalienable right to share in the profits of industry. And, in fostering such a conception, it may well be that profit-sharing rather than creating a more satisfied workman unlocks a veritable Pandora's box of further labor difficulty.

Two outstanding difficulties, therefore, have been intimately associated with the operation of profit-sharing plans up to the immediate past. One has been the tendency to regard cash distributions as deferred wage payments legitimately due. The other is the tendency of the worker to conclude that he has an inalienable right to share in profits. Minor perplexities have also been experienced but have proved to be easily surmountable. The two major difficulties, however, must be faced, for they strike at the very purpose profit-sharing endeavors to achieve, and if not overcome they tend after a time to create even greater discontent than the plan was originally inaugurated to mitigate.

Cash Versus Stock Payments

Coming back to the question of whether the business man today has discovered something new in profit-sharing, it should be noted at once, with respect to the deferred wage-payment difficulty, that cash distributions are giving place to payments in the form of stock. Two years ago, Jacob D. Cox, Jr., President of the Cleveland Twist Drill Company, after five years' experience with a profit-sharing plan carrying cash distributions made the following significant statement:

> We doubt the desirability of distributing profits in cash and believe that it is much better if it can be arranged to pay in stock or some form of interest-bearing securities. The relation of stock ownership is understood by everyone, and the employee appreciates the stock he receives and understands what is the source of the income he receives from it. But a system of profit-sharing where the returns are paid in cash is apt to seem to him only a method of deferring the payment of a part of his wages.

In 1919 new profit-sharing plans established in industrial concerns still provided for cash payments. During 1920 the shift to payments in stock was quite apparent, the most notable example being the International Harvester Company plan which, as already indicated, set aside sixty million dollars in stock for profit-sharing distribution. In the Henry A. Dix plan 80 per cent of the payments are to be in stock. There is unquestionably a trend today toward stock rather than cash distributions, although this is by no means universal. The George Eastman plan, regarding which he recently spoke so optimistically, distributes its profit-shares in cash.

Where the substitution of stock for cash payments is being made, the concepts of wages and profits are kept separate and distinct, and the difficulty experienced with workers that mix them up is avoided. There is no logical way in which a worker receiving profit-sharing distributions in the form of shares of stock in the company can fall into the misconception of regarding them as deferred wage payments.

In surmounting this difficulty the business man can undoubtedly expect better results from his profit-sharing plan; but the second difficulty will not be downed so easily. To the question whether the workman has an inherent right to share in profits, no simple answer has yet been forthcoming.

It is admitted by all that the chief incentive in profit-sharing is holding out to the worker the idea that by loyal co-operation he can materially and directly increase his employer's profits. What of labor's answer, then, that, if this be so, labor has a *right* to a share of the increase thus effected? The question is intriguing; especially in the light of the criticism of many that labor as such *does not* as a rule have a direct influence on profits.

Here apparently is a dilemma. Either labor through added effort is able to increase profits proportionately, in which event it would seem that it has some right to share in the increase, or labor does not have this direct effect on profits, in which case the employer who utilizes a profit-sharing plan is holding out to his workers a false appeal.

There are evidently still further difficulties involved in the very idea of profit-sharing, for an understanding of which it is necessary to examine briefly several pertinent factors involved in the realization of profits. The most important of these are risk and management.

Profits as ordinarily understood are inseparably connected with risk. They represent the difference between outlay and returns. Whoever takes the risk involved in the outlay—whether he be investor, organizer, or manager—is inevitably responsible if losses occur and thus has a manifest right to what profits may accrue.

Risk and Management

In this connection, the question has been raised whether the worker, in sharing in profits, should not perforce share in losses also. Some companies, as for example the A. W. Burritt Company, have attempted to meet this suggestion by inserting into the profit-sharing plan a clause providing for loss-sharing; others have arranged for reserve funds, to which both management and workers contribute, and which are designed to meet contingencies of business depression or disaster. It will be interesting in a moment to look into the workers' reaction to loss-sharing schemes. They may be wholly without merit, but their attempted installation does serve to emphasize the fact that the making of profits is inseparably connected with risk and the possibility of loss.

This fact should be held in mind along with another consideration. The loyal co-operation of labor is undoubtedly one of the factors making for the success of any enterprise, but labor receives a guaranteed return in the form of current wages (which, by the way, true profit-sharing has no influence upon). Furthermore, the realization of profits depends upon many other factors besides the efforts of labor, chief among them being efficient organization and management. Many firms are unable to realize profits for long periods of time. These may be called marginal enterprises. Those above the margin hold their position and make profits because of certain favorable circumstances and because of exceptional management. The successful solution of production problems and the intelligent buying of raw materials and selling of finished products are functions of management. Anticipating the nature and extent of the demand for a given commodity is a function of management. A mistaken judgment in these matters, no matter how loyal and enthusiastic the working force may be, will quickly wipe out a surplus and destroy profits. In a word, profits are directly traceable to good management and only remotely to labor.

The most direct way, therefore, for labor to influence profits would seem to be to secure a voice in management. But this is another story, which, though important, provides no answer to our previous question. It simply complicates the difficulty still further, for labor has been quick to sense the relationship between profit-sharing and management-sharing and, in answer to the employer's effort to keep the two concepts apart, simply takes the further step of demanding a share in both.

Is it possible, then, for the employer to meet the tendency of the worker participating in a profit-sharing plan to conclude that he has a *right* to share in the profits, a conclusion which usually robs the plan of its prime incentive? A workman will not put forth additional zeal to secure something he thinks he has a right to anyhow.

By asking him to share in losses also, the employer creates still further trouble, especially where no management-sharing is allowed. The worker does not take kindly to sharing in losses when he may have little power to influence the outcome either one way or the other. Can you blame him for preferring to gamble with his eyes open? Should he be taken to task for choosing to risk the little he has on the stock exchange where he can at least see when the movement is up and when down, rather than accept blindly a cat in a bag?

Profits are directly traceable to good management; losses to poor management. To ask the worker to share in losses, without giving him some say in the management, gets nowhere in the end. It simply begs the whole question.

Management-Sharing

Henry S. Dennison, president of the Dennison Manufacturing Company, takes a very interesting stand in this matter. For years he has successfully operated a *limited* profit-sharing plan applying to his executive employees only. This plan provides for management-sharing. About two years ago, he extended the plan to cover the rank and file of workers, and said:

> Its vital factor is that it followed and grew out of management-sharing. . . . I became convinced that no general results could be looked for from employees' profit-sharing except where there was a fairly well-grounded plan of employees' management-sharing; and we here would expect failure from our recent adventure into the fields of profit-sharing except for the influence of the Works Council in selling continuously the profit-sharing plan to the employees and in giving them such a share in management that, as a group, they can, in the course of time, have a very real effect upon our profits account.

Mr. Dennison is a successful business man who does not hesitate to couple profit-sharing with management-sharing.

But Mr. Dennison does not express the conviction of any considerable group of business men in this country, in spite of the fact that over 750 works councils were discovered among industrial concerns in the United States in a late survey. It is the worker who is so intensely interested in management-sharing and industrial democracy schemes. And so is the public interested, if the wide publicity given by the newspapers to such developments may be taken as a criterion.

Probably more representative of the average business man's sentiment is the recent statement credited to George Eastman when speaking of his profit-sharing plan, on which occasion he is quoted as saying:

> There is an idea spreading in industry that the next step in the evolution of better relationships between employer and employee is the one of industrial representation. By that is meant giving the worker some sort of vote in the running of the business. I am afraid I do not agree that a program of that sort is advisable. That is not evolution in industry. That smacks more of revolution.

At the same time, Mr. Eastman expressed his belief in profit-sharing as the solution of the employer-employee relation!

The Prevailing Theory

Most business men agree with Mr. Eastman regarding management-sharing. They believe it leads directly towards bolshevism. Now this is a serious matter to face. If by giving labor some participation in management it could be assured that the worker would get a better understanding of the difficulties management is constantly confronting, of the pre-eminent importance of efficient management to the success of a business enterprise, and of the limited part labor plays in the complexity of modern business organization, the effect would doubtless be salutary. If management-sharing can educate labor to its rightful place in industry there is unquestionably no better solution of industrial unrest than just this.

In the past, however, labor has invariably taken all the power it could get and has then immediately set about getting more. If, therefore, granting to labor a limited place in management should mean an attempt on labor's part to usurp the functions of management, unmindful of the disaster that would inevitably follow, it would be a gigantic calamity.

We are not interested here in passing judgment either one way or the other on management-sharing. All that the writer hopes to do is to show the intimate relation between it and profit-sharing, in which connection Mr. Dennison's statement should be carefully pondered. In encouraging the idea that labor has a right to share in profits, profit-sharing not only tends to rob itself of the incentive it depends upon but it leaves the door wide open to the conception that labor should share in management also. Profits are directly dependent upon the efforts of management, and asking the workers to share in the one undoubtedly raises the question of their sharing also in the other.

It was intimated at the beginning that the business man, expounding the virtues of profit-sharing in the present revival, may be interested in features that others are not stressing. May it not be that he is more interested in its *immediate* benefits than in its *ultimate* effects, that he is considering the present period of unrest with no thought of what may come later when prosperous times prevail once more? This may be; but if such a surmise is correct, he had better get over his notion that profit-sharing is a cure-all. If the majority of business men indulging in profit-sharing ventures consider, as Mr. Eastman does, that management-sharing is a menace, they should revise their statements about profit sharing providing "the solution of the employer-employee relation." For, in the premises, it is more of a hoax than a cure-all.

As a temporary expedient, and closing one's eyes to the troubles of tomorrow, profit-sharing is undoubtedly a stimulus to increased loyalty. Coming as a new idea, it is invariably embraced by the workers with a fair degree of enthusiasm. In focusing attention upon that which is most directly associated with the successful operation of a business—namely, its profits—in which the workers are permitted to share, it taps a tremendous source of additional zeal. To be interested in a company's profits, one is bound to be interested in its success, and this implies increased co-operation and loyalty, at least until the two main difficulties mentioned have crept in. By far the great majority of *existing* plans demonstrate this truth.

But it is to be expected that existing plans achieve the objects aimed at by their inaugurators, or they would be discontinued. There is no reason why an employer should continue to give away money where the stimulus to increased co-operation is burned out. Past experience shows conclusively that when the workers lose interest the plan is abandoned. The significant thing to hold in mind is not that existing plans are successful, which may be taken for granted, but that nothing permanent is to be expected from them. This point was summed up as follows by the writer, after his investigation of three years ago:

> The oft-repeated cycle noted in the experiences with discontinued plans, namely, introduction with enthusiasm and high hopes, gratifying success for a certain period, and finally abandonment on account, chiefly, of lack of appreciation by workers, labor disturbances, or disproportionate costs as against results achieved, tends to weaken one's faith in the stability of plans now in operation and impels one to conclude that profit-sharing plans are possible of successful maintenance for limited periods only.

Future Results Must Be Considered

What is profit-sharing then? Is there any escape from the dilemma presented in a preceding section? Is the appeal held out by the ordinary profit-sharing plan a false appeal? Must profit-sharing be buttressed by management-sharing to achieve permanent results? And, if the latter be true, is such an outcome what the average employer is after? Is profit-sharing, after all, to be looked upon as even a partial cure for our industrial ills, or is it ultimately just a colossal hoax?

The weight of opinion among business men is undoubtedly against combining profit-sharing with management-sharing. Possibly this opinion will change, but at any rate no other plan promises to overcome the unsurmounted difficulties mentioned above—difficulties that have wrecked many an excellent profit-sharing plan, which at the start secured the support of the workers only to lose it later when the newness of the plan had worn off and the enthusiasm had dwindled out.

THE EDITORS' PAGE

Why Every Plant Should Save Lumber

IN an article appearing in this issue on management results in a veneer box shop, E. E. Ames, the author, vice-president of the organization whose methods he describes, makes the following statement:

> The stock wastage is today 10 to 15 per cent less than before the management was improved, although the veneer and lumber now available are inferior in quality to that which prevailed five years ago.

A 10 to 15 per cent annual saving is indeed worthy of special mention aside even from the economy of operation which achieved it. Colonel William B. Greeley, chief of the United States Bureau of Forestry, at the request of the Federated American Engineering Societies, has prepared an outline of important facts bearing on the national lumber supply. He shows that the original 5,000,000,000,000 bd. ft. of timber in our virgin forests have been reduced to 1,600,000,000,000 bd. ft., while only 600,000,000,000 bd. ft. of culled and second growth exist to replace the used portion. Annual consumption is now at the rate of 60,000,000,000 bd. ft., or in 37 years, barring reforestation, we will have used up our last stick of timber.

As a matter of fact, 75 per cent of all timber being cut is not replaced. Soft wood is used 8 times as fast as replanted and hard wood 3 times as fast. In round numbers, then, 50 years will see the end of the American forests as things are actually going today.

Retail lumber costs are at least double what they were 12 years ago. From 1840 to 1921 the advance was 3½ times as rapid as the price index rise for all commodities. In 1915 the lumber and paint cost for a ready-cut, one-story, five-room house was $883. Today it is $2900.

Increased costs account for the drop in annual per capita consumption—345 bd. ft. in 1870; 516 bd. ft. in 1906; 315 bd. ft. in 1920. Meanwhile quality has fallen off to an alarming degree, as any purchaser of a carload of lumber will testify.

In the eastern and central sections the predicted lumber famine is at hand. Reforestation will not help the present emergency. Trees take a long while to grow and the wood pulp producers are the only group who have started any large scale operations to restore timber land. Anyway, second growth scarcely ever equals the virgin timber. The redwoods of California and the pines of the Carolinas probably never will be duplicated.

Immediate conservation steps should be taken by every user of lumber in any form. Grading must be made a science. Exact nomenclature and specifications will have to be developed. Complete knowledge of poorer and cheaper grades must be obtained so that they can be substituted to lessen the drain upon finer varieties.

Above all, present waste and prodigality must positively be stopped. The wood technician, the chemist and the engineer are doing their part. It is squarely up to each manufacturer and each shipper to do his.

Mr. Ames shows that intelligence and a definite manufacturing program make large savings possible. The Ford Motor Company at its Highland Park plant actually *salvages* 90,000,000 feet of lumber annually from what the ordinary plant would call mere scrap. The aggregate yearly lumber economy of all the large and small plants using wood in any manner would be of sufficient volume to insure an adequate supply until reforestation can become effective.

The Profession of Management

AS pointed out by Mr. Simonds in his article, "Some Fundamentals of Management," printed elsewhere, under ordinary conditions the success or failure of a business undertaking depends almost entirely upon its chief executive.

He may have many sub-managers and assistants, capable or otherwise, but their success is his success, and their failure is his failure. He may have a board of directors, or some other supervising body or individual over him, but that does not lighten his responsibility. It is up to him to see not only that the policies and decisions of these supervising bodies or individuals are carried into effect, but also to see that these policies and decisions do not differ materially from his own. If they do, it is time for him to look for another job, for either he is incapable of making right decisions himself or—almost as bad—unable to "carry his board with him" and in either case there will be trouble and the trouble will be his.

Nor is the direct burden of management an easy one. Theoretically the manager has merely to select his capable assistants—and his ability as a manager shows nowhere more clearly than here—delegate his authority to them, and then go off and golf or motor or do something else equally remote from the business until the next board meeting calls him back to exhibit the gratifying results of his vicarious good management to the eyes of his admiring superiors.

There was a time when this was thought to be more than theory. It was, however, quickly discovered that the managing executive who delegated all his authority and practically stepped aside was no longer a manager. He was merely a supernumerary. The manager may and should shift the operating details of the business to the shoulders of subordinates, but there is still a correlation and supervision of the operating forces that is essential to effective operation and this duty is distinctly his. Also there is a policy control that is quite as important as organization control, which cannot be shifted. As stated by a recent writer[1]:

> The "clean desk" may still be a symbol of efficient management, but across that desk must flow an endless suc-

[1] Richard Neustadt in *Administration*, May 1923.

cession of digested reports and tabulations on every phase of the business. The "nothing to do" idea may still apply to the executive's freedom from routine tasks, but this release from routine tasks is for the sake of the far more difficult tasks of policy control.

The whole management problem is tersely summed up in Taylor's "Shop Management" as "knowing exactly what you want men to do and then seeing that they do it in the best and cheapest way." That is comprehensive and it sounds simple, but the man who can live up to it is a successful manager. As stated by the writer just quoted:

> Determining what is to be done, directly involves the fixing of policies, the setting of objectives and the planning of methods for their accomplishment. Getting the desired results efficiently involves at least sufficient knowledge of the whole economic and technical regime of finance, production, sales, public and industrial relations to make use of experts as directors of each of these functional phases of executive control. It requires also at least sufficient knowledge of human nature to make possible the assumption of genuine leadership and to inspire a genuine loyalty and devotion among subordinates.

Formerly the manager of a business occupied his position by virtue of ownership, or relationship, or accidental succession. It was a hit or miss method of filling the most important of all positions. Today the chief executive must ordinarily prove his right to the executive position by his capacity for leadership—by his ability to make a success of the business. He may still be the owner or largest stockholder—or a friend or relative of these. As a consequence of the corporate form of organization he is usually the choice of the majority of the stockholders. That alone will not, however, "hold the job." The strenuous and intelligent competition of today has changed that and if he would retain his position he must know what he wants his men to do, and have the ability to see that they do it in the best and cheapest way. If he cannot do this he will quickly be replaced by a better man or the business itself will go to pieces beneath him.

* * *

To sum the matter up briefly, the managerial position is a very desirable one—dignified, important, and well-paid—but it is no sinecure. On the one hand is the business itself with its multifarious details, its changing conditions, its strenuous competition and its complaining workers, waiting to be told what to do and be supervised in the doing. On the other hand are the directors or other supervising body, exacting, and difficult. Beyond this there is always a hungry and insatiable horde of stockholders, who must have dividends—they do not care how these dividends are obtained, but have them they will. The conscientious manager's position with all this upon him is one of long hours, hard work, constant watchfulness and heaviest responsibility. It may be a white collar job, but the white collar is frequently wilted by the perspiration of both anxiety and arduous effort. It may be a life well worth while, but it is not an easy one.

The 12-Hour Shift Outside of Steel

PRESIDENT HARDING had a deep interest in the operation of the 12-hour working day in industry, and hoped that the long turn would disappear from American factories during his administration. It seems probable that his wish will become a practical reality in the great iron and steel industry before the end of the presidential term for which he was elected, and in his own words there will come "a better and wiser form of organization of the productive forces of the nation."

As these comments are being written the executives of many of the great steel producing companies are hard at work on plans to change their own operation from the 12-hour turn to one of fewer hours. The problem they face is one of management, and the desired result can be and will be achieved without either economic or financial disturbances to the progress of American industry.

However, it is unfair to think of the iron and steel industry as unprogressive in waiting until 1923 to eliminate the 12-hour turn, and say nothing of and about the many other industries which are still working to greater or less extent on the long shift. These others include the manufacture of glass, cement, lime, brick, pottery, heavy chemicals, fertilizers, explosives, dyes, industrial alcohol, wood distillates, refined corn products, soap, glue, drugs, sugar, salt, petroleum, cottonseed oil, paper, flour, rubber, breakfast foods, automobiles, textiles, electric power, gas, drinking water, and ice. The engineers' report on the 12-hour shift in industry, published last year, estimated that at that time there were 300,000 wage-earners on 12-hour shifts in American industry, and that of these about 150,000 were engaged in producing iron and steel. Accepting these figures, when the iron and steel industry has changed to the shorter turn, there will still be 150,000 or more 12-hour turn men unless the other 40 or 50 continuous process industries do likewise.

Looking forward just a little in point of time, the request of President Harding to the directors of the American Steel and Iron Institute to give him a pledge to eliminate the long working day, and the executive action now being taken within the industry itself, will form another milestone in the shortening of hours of labor. For, not long ago, as time is measured by the progress of the human race, men and women worked from dawn until dark. In the fifth year of the reign of Queen Elizabeth (1562) the "Statute of Laborers" was passed, and was so securely based on public opinion and deeply-rooted custom that it remained in force down to the time of the industrial revolution. It therefore reveals to us something of the working conditions of the sixteenth, seventeenth, and even the eighteenth century:

> All artificers and labourers being hired for wages by the day or week shall, betwixt the midst of the months of March and September, be and continue at their work and not depart until betwixt 7 and 8 o'clock at night, except it be in the time of breakfast, dinner, or drinking, the which time at the most shall not exceed two hours and a half in a day, that is to say, at every drinking half an hour, for his dinner one hour and for his sleep when he is allowed to sleep, the which is from the midst of May to the midst of

August, half an hour; and all the said artificers and labourers betwixt the midst of September and the midst of March shall be and continue at their work from the spring of the day in the morning until the night of the same day, except it be in time afore appointed for breakfast and dinner, upon pain to lose and forfeit one penny for every hour's absence, to be deducted and defaulted out of his wages that shall so offend.

Some 400 years later, the working day in industry is 8 or 9 hours long, with the few exceptions which are rapidly passing. If the tendency continues we may look for efforts to establish a 7-hour or 6-hour working day, or a 5-day week or to adopt some other plan whereby the work of the world will be done with fewer hours of human labor than are now required.

Seeing Management at the Right Time

HENRY L. GANTT, at the meeting at which he explained his form of chart which we now call the Gantt-type chart, said this:

> If we can measure and evaluate the productive efficiency of the manager as we now measure that of the workman, we may hope for better results. . . . I offer as part of the work of measuring executive efficiency the chart shown in my paper.

The thought underlying this form of chart is anticipative visualization in management. That is, seeing management at the right time. It brings this about by presenting facts in their relation to time, for if we know when events are taking place or the rate at which work is being done, we can then make decisions which will affect the future with a great degree of certainty.

Chester B. Lord has now given us a new application of these principles in the form of a control board which shows the exceptions to established routine, visualized in a striking fashion so that they compel attention and correction.

The system which Mr. Lord has developed and applied in several different industries as widely varying as the manufacturing of agricultural machinery, making small tools, and printing, has six rules:

1. In repetitive fabrication the purchase, fabrication, and delivery of material is based upon the actual product finished.
2. Time, being the basis of manufacture, all other factors, to be intelligible and comparable, must be presented in their relation to time.
3. Accuracy demands the visualization of 100 per cent of all factors, 100 per cent of the time.
4. Any chart or graph which presents results demanded from or achieved by any department shall not be posted by the department concerned.
5. Any check to be effective must be obligatory, recurrent, and unevadable.
6. Consistency of procedure must never interfere with an obvious exception to that procedure or its system.

Inasmuch as the principles underlying this system have had the test of repeated application over a number of years, we may accept as true that a new management mechanism of great possibilities is now available for the use of industrial executives.

Charting and Rewarding Better Work

THE incentive record and the bonus for improved workmanship are two tools of management which have developed side by side in American industry, but whose relation to each other has not been clearly brought out. In the opinion of B. A. Franklin, Vice-President of the Strathmore Paper Company, whose article, "The Progress Chart and the Bonus Method," appears in this issue, the two ideas belong logically together. They should be hooked up, as it were, and made to work in a single set of harness.

Few industrial executives will be inclined to disagree with Mr. Franklin's statement that one of the chief problems of management is how to get the highest quality and quantity production per worker per working day. Many could doubtless be found who would assert that this is *the* problem of management engineering, and that sooner or later all other questions are found to converge in this one.

In any event, there appears to be a genuine and widespread interest in the matter of incentive records, as the basis for a workable system of bonus rewards for work that shows, when tested by comparison with reasonably established standards, a steady improvement in either quality or quantity, or both.

Mr. Franklin's emphasis upon standardization of the task as a vital factor in the plan is logical. This applies both as to the detailed method of the performance of the task and to the standard amount to be performed, in quality and quantity. Beyond this, management must definitely and persistently help the worker to progress:

> Men must have definite goals set them at which to aim, and the way to the goal must be cleared for them as much as possible. It is both foolish and unfair to expect the best of them unless they are offered the best conditions.

From the 8 progress charts and 3 tables reproduced in connection with the article Mr. Franklin draws certain significant conclusions. Where no direct reward is offered for improvement, if reasonable progress is expected one of two conditions must obtain—either the workers must be above the average in intelligence or the standard set must be one in connection with which natural pride of workmanship will operate.

In his conclusion Mr. Franklin comes back once more to the responsibility of the management. He says:

> In the case of either the simple progress record, the bonus method, or the combination, experience has shown very clearly that the great essential is the close co-operation of the management. To put up a chart, to give bonus rewards, and then to leave it to the worker to get results is to court failure, indifference, and even resentment on the part of the worker when expected results do not follow. It is partnership in operation, even in the minor details, that gets results.

Mr. Franklin's "conclusion of the whole matter" is that while the progress record or chart by itself is of decided value, the best results are obtained by its use as an illuminative and explanatory picture, with the bonus for reward. As both plans have been tried in Mr. Franklin's organization, his conclusions appear to be of positive value to all executives.

THE READERS' PAGE

A Word of Explanation

Editors of Management and Administration:

In regard to my next article, which will be on the subject of "Manufacturing Freight Cars," may I say that the two passenger ships which I am personally conducting towards completion, one of which is to be launched July 28, are occupying every minute of my time, and I see no let-up until about the first of August. Consequently I regret to have to postpone my fifth article for another month. I will prepare it between August 1 and 25, and see that it reaches you not later than August 25, for publication in the October number.

William B. Ferguson,
Consulting Engineer

Vice-President in Charge of Operations

Editors of Management and Administration:

In several issues of *Administration* you published articles on "Budgetary Control" by J. O. McKinsey. That these articles interested me greatly is indicated by the fact that I purchased from your company a copy of Mr. McKinsey's book, "Budgetary Control."

As a subscriber to your magazine I am wondering whether it would be possible for you to clarify the duties of the vice-president in charge of operations as outlined in Mr. McKinsey's plan. I believe that I understand clearly the duties of the several other vice-presidents, and if you can enlighten me on the duties of this one it would be greatly appreciated.

Thanking you for the courtesy of a reply and with best wishes for the continued success of your excellent magazine, I am

Very truly yours,
F. Edwin Titlow

Editors of Management and Administration:

Mr. F. Edwin Titlow's letter to you, forwarded to me, is received. It is my thought that the vice-president in charge of operations, or, as he is sometimes called, the vice-president in charge of administration, should have supervision over certain departments whose main object is the facilitation of the operations of the major departments of sales, production, and finance.

By this plan of organization the number of executives reporting to the president is reduced. It has been my experience that the most effective form of organization is one which provides for not more than four or five executives reporting to the chief executive. Otherwise, he is so occupied with details that he has little time to give to the consideration of the major problems of the business.

The vice-president in charge of administration can dispose of all minor questions brought up by the heads of the departments which are under his jurisdiction and only the major problems will be referred to the chief executive. The specific departments which should be placed under his control will vary from business to business. Those given on page 275 are intended to be illustrative only.

You will notice that a different form of organization, which provides for a controller in charge of standards and records, and for a personnel manager, is given on page 277. This form of organization is undoubtedly preferable where it is practicable. In many small firms it is not feasible to have such an organization and in many large ones it is impossible to secure permission to have it. In these cases a vice-president in charge of administration is useful.

J. O. McKinsey

A Query and a Reply

Editors of Management and Administration:

I am very much interested in the charts prepared by Dr. Lewis H. Haney, and wish to ask, if it is a fair question, why the index of the National Industrial Conference Board is used for the cost of living curve, instead of the Bureau of Labor Statistics index. I am particularly interested in this subject, and have been under the impression that the Bureau's figure was considered more authoritative.

E. K. Sheil.

Editors of Management and Administration:

Mr. Sheil's inquiry is a fair one, and I am glad to reply to it. Our use of the National Industrial Conference Board's cost of living index instead of that of the United States Bureau of Labor Statistics is due principally to the fact that the Industrial Conference Board's figure is a monthly figure, while that of the Bureau of Labor Statistics is a quarterly index of the cost of living. For the purposes for which the index is used in this case a quarterly index of the cost of living is too infrequent.

Aside from this consideration there is little that makes one index preferable to the other. The purpose of each is to measure the trend of living cost, and the variance between the two is extremely slight.

Comparing the two indexes over a period of three recent years, a very high degree of correlation is found in their trends, the coefficient of correlation between the two being 0.98984. Maximum correlation is 1, and therefore, from a practical point of view, both indexes indicate the same results. We constantly check the Conference Board's figure with that of the government.

Lewis H. Haney.

Reactions on Sesqui-Centennial Suggestion

Editors of MANAGEMENT AND ADMINISTRATION:

You are indeed to be congratulated on the constructive suggestion made in your open letter to the Directors of the Sesqui-Centennial.

Of utmost importance to our very national existence is the successful solution of the problem of industry, a prerequisite of which must be a widespread and sentient apperception and appreciation of the interplay of socio-economic forces, a condition which at present can scarcely be said to exist.

It may be well to remember that the factory system, as we know it, has developed in a series of steps. Each step was, perhaps, longer than the preceding one; nevertheless they were sequential. While each brought its own attendant train of troubles, such troubles were all cognate, and potential solutions were deducible from the experiences of the past steps. This spread of the industrial era carried with it marked changes in the social (human) relationships, evidenced by the so-called "labor troubles."

Numerous—and abortive—panaceas have been and are still being offered. That the fundamental diagnosis may be in error seemingly has not been even suspected. Yet the very basis of present-day industry—the *concentration* of the means of production in specific (economically favored) localities, as in the prior stages—was causation in itself sufficient to create conditions inimical to a mode of human relationships which was relatively satisfactory under the old conditions.

Just as a city's congestion calls for traffic control not needed in a small town, so the sudden massing of men and materials demands a degree of industrial control not dreamed of by the older economists. And upon this very thing—a thinking and conscious directive control of the "fluents" of industry—depends the peace and prosperity of this, our land.

S. N. CASTLE.

Editors of MANAGEMENT AND ADMINISTRATION:

The idea which you bring forward in your editorial open letter to the directors of the Sesqui-Centennial is one worthy of greatest consideration by the directors.

No association or society whose object is the perfection and dissemination of any form of control which is essential to industry can fail to see in the carrying out of this suggestion a most valuable impetus to good management in industry.

It is to be hoped that the directors of the Sesqui-Centennial will take favorable action in this matter. If they do, it will be a most important duty for the organizations interested in the various branches of control to co-operate most effectively with the directors, in order to make the exhibit the most valuable medium of education industry has ever known.

I am sure that the National Association of Cost Accountants would do its full part in making an exhibit of cost accounting and cost control a feature which would never be forgotten.

J. P. JORDAN.
President, National Association of Cost Accountants

Editors of MANAGEMENT AND ADMINISTRATION:

I have read the open letter to the directors of the Sesqui-Centennial, subscribe heartily to the recommendation, and congratulate you on the public spirit which has prompted it. A carefully planned, logical presentation of the latest and best achievements in the control of operations in leading industries would include all the elements contained in the general plan already announced by the directors, and infinitely more; and it would constitute a section of the industrial exhibit which would attract executives from all parts of the United States—and many from abroad.

The value of the exhibit would of course depend upon the competence for the particular purpose of the (to use an art-exhibition expression) "hanging committee" appointed to select "the best, the most advanced, systems and methods of valuing and controlling the operation of the assigned branch of industry." Were it such a group as was selected by Mr. Hoover for the investigation of waste in industry, the educational value of the exhibit would be assured.

H. S. PERSON.
Managing Director, Taylor Society.

A Forecast and Some Comment

Editors of MANAGEMENT AND ADMINISTRATION:

We are all wondering right now: "What is the matter with business?" Is there anything wrong outside of the unseasonable weather? Why does Wall Street seem to be predicting a slump? Usually Wall Street is six months ahead of the rest of the country in determining the trend of business. Its channels of information are well-nigh perfect, but for once I am not afraid to say that Wall Street is wrong. What we are witnessing outside of seasonal fluctuations is not a slump in business, but a determined effort on the part of cabinet officers and large banking interests to prevent overexpansion of industry, unduly high labor costs, unnecessary rising in prices, and as a summary of all three, an inflation of credit which might bring a repetition of 1920. It is my opinion that their concerted and determined efforts have met with unusual success. What might have been a panic was nipped even before the bud.

I am going to throw precedent to the winds, and give a business forecast for the next six months, which has been arrived at after careful study of many available statistics and facts. What I am going to say will probably differ materially from what many of your readers think, and also from the opinions of the professional forecasters.

I see no reason for feeling any nervousness about the next six months. The business which cuts its commitments and reduces its inventory at this time will be sorry before November 1. I advise purchasing a little better than normal supplies, and I am going to enumerate a few reasons and facts from which I formed this opinion.

Production has slackened, but consumption is going on at a high, steady rate. We will enter the fall trade with lower stocks, a good thing for trade. There is no unemployment. Large businesses are now attempting to revise the immigration restriction laws. Bank clearings are exceedingly high. Interest rates are normal. The money market is in excellent condition, due mainly to the masterful handling of the Treasury financing by Mr. Mellon. Seven and one-half billion of refunding has been accomplished in the last two years without even a semblance of disturbance in the money market. It will probably take 25 years for all of us to recognize the tremendous services rendered by Mr. Mellon to this country.

Pig iron and steel productions for May have broken all previous records, not excepting even the abnormal production of the war. Only two weeks ago, Mr. Gary stated that production at the present rate, which is 90 per cent of capacity, is practically assured for the balance of this year. Crop conditions throughout the country are better than normal. Freight carloadings for the month of May exceeded by one million cars the freight carloadings of May 1922. Of this increase only 390,000 cars are due to the coal situation.

Inventories throughout the country are 25 per cent below normal. There is probably no better posted man on inventories in this country than J. H. Tregoe, Secretary of the National Association of Credit Men. Mr. Tregoe says: "There are no surplus stocks in this country, so far as I can discover." Mr. Barnes, President of the National Chamber of Commerce, in his recent address before that body in New York City described the conditions in Europe as distinctly on the up-grade, and our chances for export business excellent during the next few years. He ridicules the fear of our inability to compete with foreign cheap labor, and gives ample and conclusive support for this opinion. All of this is stated after an extended study of Europe on the spot, by probably the best equipped man for such a survey in the United States.

True, there is seasonal slackening at this time of the year, but there always is a seasonal slackening of demands in the summer, and I am certain that this will be followed by good demands for all classes of merchandise in the fall.

Do not forget that the farmer comes into the market for everything about August 1. If anything, there will be a distinct shortage of goods in October, and the present hesitation of business is not caused by the consumer but by the manufacturers and dealers, who have become overcautious on account of the heavy inventory losses of 1920 and 1921, still very fresh in their memory.

These are my reasons for not being afraid to predict a healthy and profitable business this fall.

C. M. STEPHENS,
Shur-on Optical Company, Inc.

Editors of MANAGEMENT AND ADMINISTRATION:

I should like to make a few running comments on Mr. Stephens's very interesting and suggestive discussion, taking his points up in order.

First, it seems rather [illegible] that [illegible] banking interests deliberately applied the [illegible] business boom which was on last fall. This [illegible] prevented serious overexpansion and [illegible] peak. It will also tend to limit the extent of the reaction. This, however, does not entirely [illegible] a reaction, and the evidence appears to me to s[illegible] that we are at present in the midst of a considerable [illegible] swing, which, while it is not a major depression, is not to be ignored.

I agree with Mr. Stephens that nervousness concerning the next six months is not necessary, but I believe that caution is desirable and care should be exercised in many lines to prevent the making of too large commitments. It may well be that in some trades better than normal supplies can be purchased with advantage, but it is also true that in other trades this would not be wise. The outlook for automobiles, automobile tires, leather, copper and cottonseed oil is certainly doubtful, to say the least.

I doubt whether it can be truly said that consumption is going on at a high, steady rate in all lines; and we certainly are not going to enter the fall trade with lower stocks in all cases. Bank clearings can be used correctly only when allowance is made for price level and for seasonal variations. Debits to individual accounts are a better index of business activity, and they have decreased for two months, eliminating seasonal variation.

While it is true that pig iron production broke all records in May, it is also true that the daily average production declined in June. More than that, the unfilled orders of the United States Steel Corporation have been on the decline for three months, which is certainly more indicative of the future than the past volume of production. While crop conditions may perhaps be called good, it is to be noted that large crops of grain may be a disadvantage at the present time. Wheat, rye, and oats are so low in price as to constitute a very bad feature in the situation; and the larger the crop, the worse the situation will be. The large freight carloadings may be simply an indication of overproduction. In any case, Mr. Stephens fails to note that merchandise carloadings have been declining. He also fails to note that there is a serious threat of radical anti-railway legislation.

There is a great deal of talk about the absence of excessive inventories, and undoubtedly merchants in many lines have been buying from hand to mouth. It remains true, however, that there is an overproduction in some industries, and I believe that if prices continue on the down-grade it will be found that, as usual, there are oversupplies. Certainly, the petroleum industry is a good illustration of one which has excessive inventories, both of raw material and finished products; and the tire industry is another.

The foregoing criticisms do not mean that I am pessimistic concerning the future. They do mean that I believe in continued caution, and that we have passed the peak of business activity for 1923.

LEWIS H. HANEY,
New York University.

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

PREPARED BY LEWIS H. HANEY

Director, New York University Bureau of Business Research

Barometer of Industry and Trade

Stability Approaching: Definite Improvement Postponed

While signs of an approaching transition from the existing downward trend of business and industry to a condition of stability are apparent, our barometer, Fig. 1, shows no indication of an immediate general improvement. The volume of production and business, as reflected in such indexes as bank debits and clearings and the production of pig iron and bituminous coal, continued downward during July and is not likely to show any great reversal of trend during the next two months. Of more importance for the future is the fact that our main forecasting line resumed its declining trend in July. This indicates that there will be no material improvement in business during the next two or three months, beyond a certain gain which is normal during the Fall season of every year.

It now seems probable that no real upswing in the business cycle can occur before 1924. There is no reliable basis for forecasting just when the improvement will come—and foreign conditions remain a very uncertain factor.

The postponement of an upswing in business is borne out by the probable increase in the number of business failures which is indicated for August, and by the fact that the general trend of prices is still downward.

Signs are not lacking, however, of an approaching turn in the *forecast* for the business future. Among such signs we may mention the following:

The $\frac{P}{V}$ line shows a smaller rate of decline; and, above all, such decline as it shows is due to the downward movement of prices and not to a growing physical volume of trade. In fact, the physical volume has been declining for two months. Ultimately it is this decline which will probably reverse the trend of the forecasting line. Another factor is the recent change in the outlook for prices. While it is probable that prices will decline for at least another month, present indications show a less rapid rate of decline with signs of a more stable price level. The number of commodities which show increases or stability in price is increasing.

Still another factor which indicates the approach of a time when a more favorable forecast can be made is the decline in our index of money rates, which is now below the center of the normal area.

Finally, a study of the various graphs showing conditions in basic industries indicates that these industries are generally approaching a more stable condition. Such straws as the following show the way that the wind is blowing:

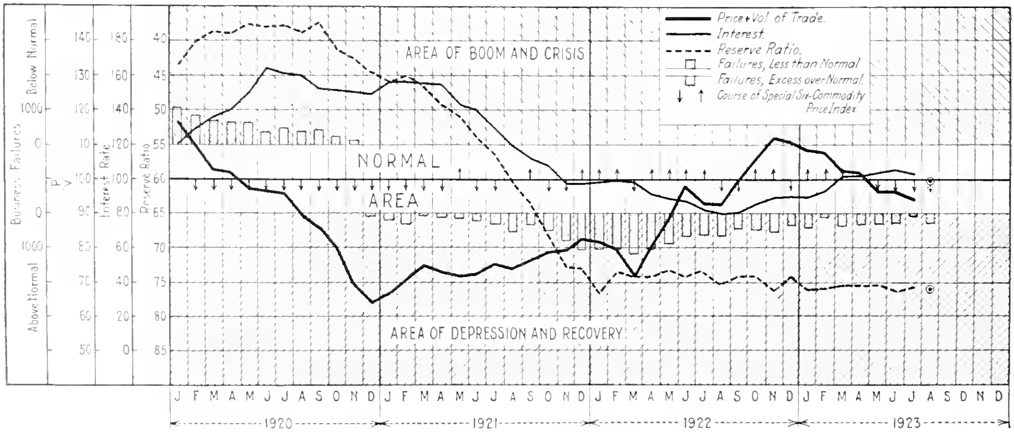


FIG. 1 THE BAROMETER OF INDUSTRY AND TRADE

Areas in which curves lie indicate that business is good, normal or poor, respectively. Curve P/V shows the trend of commodity demand, and is the ratio between Bradstreet's index of wholesale prices and physical volume of trade (carloadings times tons per car), based on 1912 as the normal year. A rise in the curve indicates increasing demand, and vice versa. Interest rate curve has been corrected for seasonal variation, and index number 100 equals 5 per cent. Federal reserve ratio of cash reserves to note and deposit liabilities is inverted to harmonize its indications with the rest of the curves, and is corrected for seasonal variation on revised basis from January 1923 on. Business failure bars are based on Dun's reports, and "normal" equals the trend for 40 years. Six-Commodity price index based on N. Y. U. Bureau special investigation. August 1923 data shown is probable trend.

Production in basic industries has been checked as indicated by the government's index and our index of railway tonnage. In Fig. 6 it appears that the value of contemplated building projects increased during July, and most students of business agree that building activity will be maintained at a relatively high level. The unfilled orders of the United States Steel Corporation, while they declined during July, fell off at a decreasing rate and steel production has held up better than expected. A better demand for pig iron is reported. Money is gradually becoming somewhat easier but there is no break in rates. Employment conditions appear to be approaching stability, with a high level of employment general. The average weekly earnings of labor have either been checked in their advance or have declined slightly. The volume of retail trade continues good. All these things seem to show that real progress has been made toward a necessary readjustment of industry and business which may be expected to bring stable conditions within a month or two.

On the other hand, advance figures for July show only a slight excess of exports over imports, which means a drawback on the possibility of recovery. Also, while the advance in wages has been checked, the cost of labor is too high in comparison with wholesale prices. The trend of bank debits and bank clearings is downward.

To sum up: the continued decline of the main forecasting line has postponed the possibility of a favorable forecast, but the signs point to the possibility of an early change in this respect. Meanwhile actual business will continue to decline gradually in comparison with the volume normal for the season. The net conclusions are, that (1) we are approaching a fairly stable condition of business; (2) that any improvement in the nature of a real upswing in the business cycle is unlikely between now and the end of 1923, though the usual seasonal gains are probable during the Fall months. There are unfavorable possibilities in the European situation which no human being can predict.

There is no essential change in our forecast contained in the July issue of MANAGEMENT AND ADMINISTRATION (to which the reader is referred) except that the possibility of a favorable forecast has been postponed for another month. That is, since the $\frac{P}{V}$ line ordinarily forecasts the trend of business by from four to six months, and since the line continued downward in July, the possibility of predicting the exact time that business recovery may be expected, has been put off for another month.

Detailed Analysis of Barometer

A study of the several factors in our barometer gives the following results:

1. The trend of prices in the most significant commodities was downward in July, the 6-commodity index falling from 125 in June to 118 in July. (The average for 1921 = 100.)

2. The index of interest rates on commercial paper declined in July and may cross the center of the normal area in August. The continued ease in money rates appears to be a favorable condition, although it indicates the existing relative slackness in business.

3. In July the number of business failures was but slightly in excess of normal. The present outlook, however, is that August will show a considerable increase. If this probability is realized it will be a strong indication of the postponement of business improvement.

4. After remaining practically stationary in June, the $\frac{P}{V}$ line declined in July from 96 to 94.4. This brings the line well down into the lower half of our normal area and indicates that there has been no material recovery yet in the intensity of demand for commodities [illegible] general [illegible] abnormally great [illegible] [illegible] This [illegible] and continued [illegible] market during the [illegible] probably longer. It [illegible] ever, that the downward [illegible] $\frac{P}{V}$ line has been more [illegible] was in 1920 and that it [illegible] the normal area. We may [illegible] that the unfavorable indication [illegible] so strong as in the previous [illegible] cline and that stability may be at [illegible] on a basis much improved over 1920.

5. The Federal Reserve ratio in July showed a minor decline from June, after eliminating seasonal variation. It continues to indicate abundant supplies of reserve credit.

While the reasons for hopefulness for the future are growing, the wise course for the new thirty days is continued caution in making commitments. There is still reason for uncertainty in view of the downward trends during July, and the possibility of unfavorable developments both at home and abroad. This is no time for such optimism as existed in early 1920.

Production and Movement of Stocks

Production Decline Rate Shows Signs of Decreasing

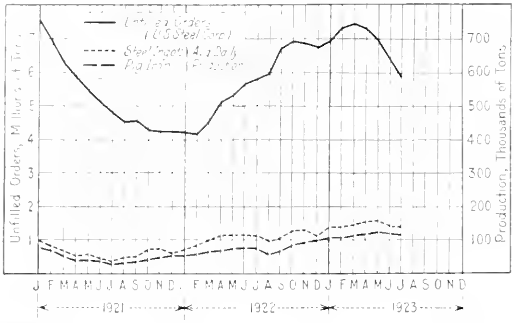
With the recent slackening in business in many lines, while production was holding at a high level, it is natural to find some tendency toward an accumulation of stocks in certain industries. This is apparent in gasoline, pneumatic tires, and zinc. (See Table 1.) The continued increase in stocks of gasoline in excess of the normal seasonal trend has for some time forecast the reductions in gasoline prices which have recently occurred. Stocks of cattle leather, although smaller than the average for 1921, continue large with relation to demand.

On the other hand, the figures show decreased stocks of raw sugar at refineries and cotton seed oil.

Sources, Federal Reserve Board, N. Y. [illegible] Bureau of Business Research

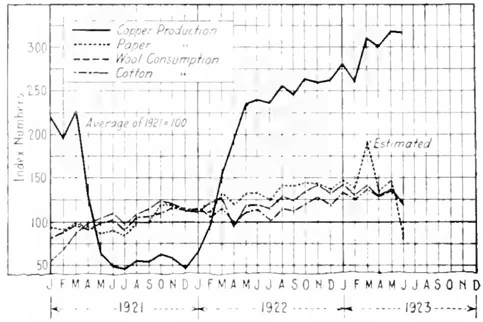
FIG. 2. RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

Railway tonnage and basic industries production corrected for seasonal variation, and the latter also for normal growth.



Sources, Iron Age, American Iron and Steel Institute

FIG. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS



Sources, American Bureau of Metal Statistics; Federal Trade Commission; Bureau of Census; Dep't of Commerce

FIG. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES

Production and Railway Tonnage

The ends of all the curves shown in Fig. 2 turn downward, indicating declining production and physical volume in basic industries.

The June index of production in basic industries prepared by the Federal Reserve Board, after allowances for the normal growth in industry and for the normal seasonal decline, dropped sharply, and a further decline is to be expected in the July index. After eliminating seasonal variation, our index of railway tonnage for July registered a decline. The index of production in manufacturing industries was also down in June, contrary to its trend in 1921 and 1922.

Conclusion. We may conclude that these declines in the general index of production show clearly a downswing in industry which has cyclical significance.

Iron and Steel Production

The month of July was one of continued recession in the iron and steel industry as is shown by a glance at Fig. 3. As to actual production, the facts are as follows:

Production. The average daily production of pig iron decreased about 3 per cent to 118,703 tons. The average daily production of steel ingots decreased about 2.5 per cent to 140,600 tons. These figures are both above any point attained during 1921 or 1922.

Unfilled orders. The unfilled orders of the United States Steel Corporation showed a decline which was about what had been anticipated. They fell about 7.5 per cent to 5,910,700 tons—a decrease of 475,000 tons. It is possible that the amount of the decrease in unfilled orders may be regarded as slightly favorable in that the percentage of decrease is less than that of the preceding month. The indications are that the rate of decrease will show a further check in August. Late reports concerning the steel industry are moderately optimistic and indicate that new business continues in good volume.

Price. As to the price situation, pig iron, while still weak, has shown a steadier tendency under the influence of better buying. Steel prices have been well maintained. The average price of eight important iron and steel products has remained practically unchanged.

Conclusion. The performance of the curves of iron and steel has been quite typical of the general industrial situation. They indicate a decided minor reaction which may be expected to terminate within two or three months in so far as domestic conditions are concerned.

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
(Index Numbers: Average for 1921 = 100)

MONTH AND YEAR	GASOLINE* 100 = 630,757,000 gals.	LEATHER* (Cattle) 100 = 19,742,000 pieces	ZINC 100 = 77,202 tons	NEWSPRINT PAPER 100 = 30,009 tons	AUTOMOBILE TIRES 100 = 4,364,000 tires	RAW SUGAR 100 = 114,000 tons	COTTON-SEED OIL 100 = 255,400,000 lbs.
Jan. 1921	89	100.7	52.2	82.5	126.2	55.9	107.4
Feb.	93	102.5	98.4	108 0	121.9	54.5	114.1
Mar.	92	102.1	101.1	130 5	119.0	86.1	140.9
Apr.	92	102.5	104.9	139 3	105.3	76.8	144 2
May	104	100.8	103.1	117 0	103.7	164.7	146 0
June	103	104.4	108.4	104.0	102.0	196.5	130.8
July	109	100.5	116.4	88.7	95.2	170.0	117.3
Aug.	108	99.5	119.7	85.0	89.2	106.1	89.4
Sept.	109	99.5	112.1	90 4	90.2	97.4	61.0
Oct.	102	96.4	105.1	100.8	76.6	93.8	34 2
Nov.	102	95.9	91.7	76.7	81.2	48.9	46.0
Dec	103	95.2	86 8	77.1	89.6	48.9	74.2
Jan. 1922	110	98.5	78.5	79.8	84.7	27.5	101.2
Feb.	110	99.0	85.1	88.5	95.6	46.7	107.7
Mar.	110	100.7	83.1	92.7	107.5	116.1	113.3
Apr.	110	95.4	78.1	93 9	118.8	202.2	117.3
May	111	101.5	67.0	82.9	125.2	197.8	118.7
June	114	101.6	52.3	82 6	126.6	179.5	99.8
July	123	98.3	38.3	77.9	115.5	166.8	82.7
Aug.	133	97.4	37.1	70.5	110.8	208.5	64.4
Sept.	146	91.5	28.0	66.3	106.1	148.0	41.7
Oct	161	90.2	24 4	62.7	105.7	99.0	20.8
Nov.	160	87.7	23.4	65.8	107.3	49.6	22.6
Dec	156	85.9	25.3	65 4	113.8	28.2	36.8
Jan. 1923	156	85.3	23.6	64.0	105.4	15.8	57.0
Feb.	154	84.0	21.5	76.7	107.6	40.2	77.1
Mar.	162	82.6	14 1	77.3	119.7	73.4	88.6
Apr.	164	81.6	13.0	67.2	129.9	184.3	93.9
May	173	81.4	11.6	62.9	139.3	211.1	92.3
June	174	84.0	16.9	60 5	159.6	166.6	87.2
July	....	....	22 2	65.0	....	151 0	....
Aug	....	....	27 5	....	....	118 8	....

*Last of month.

Production in Important Industries

The volume of production in the four important industries covered in Fig. 4 shows a downward trend. The output of copper may be said to have been checked and appears to be more stable. The June mine production was approximately 124,869 tons against 125,457 tons in May. The production of paper (all grades) shows a marked decline in June.

Cotton and wool. This is also true of the consumption of raw cotton by mills and a further considerable decline is indicated for July. The consumption of wool fell off materially in June. The estimated wool consumption of the entire industry when reduced to a grease equivalent was only 64,647,000 pounds against over 73,000,000 pounds in May.

Comparison with 1921. Of these four

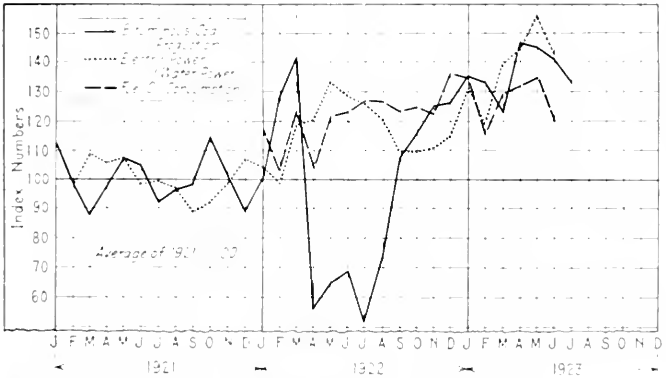
industries, three—copper, cotton and wool—appear to be producing at a greater rate than the monthly average for 1921; while the production of paper is very much smaller. It is of interest to note that our indexes of both cotton and wool consumption stand at approximately 120 (with the 1921 monthly average as 100).

Fuel and Power

Bituminous Coal. The most notable fact about the fuel and power group is probably the continued decline in bituminous coal production as shown by the sharp downward trend of the curve in Fig. 5. In round numbers, production dropped from 46,000,000 tons to 44,000,000 tons in July, a decrease which is the more notable for the reason that usually production gains somewhat during the latter month.

Fuel Oil. Another sign of the times is the sharp decline in the curve of fuel oil consumption. Our index number shows that the upward trend which began in March has been abruptly halted, and that the fuel oil consumption is somewhat below what it was a year ago.

Hydro-electric power. The output of hydro-electric power declined in June as expected, but the decrease was somewhat greater than is usual at this time. In May and June of 1922 the index numbers were 133.2 and 128.5; this year the two months are represented by 155.5 and 142.7. (The average for 1921 = 100.)



Source: ... United States ...

FIG. 5 FUEL AND POWER CONSUMPTION

Building Activity in July

Contemplated Construction. F. W. Dodge Company reports for July an increase of 11 per cent in contemplated construction, as compared with June 1923. This increase in contemplated construction, as shown in Fig. 6, reversed the tendency of the previous three months. In view of the temporary settlement of the labor troubles which were so common during April, May and June of this year, this increase is not surprising. However, at the present time labor troubles are again coming to the fore and the continuance of the large volume of construction is uncertain.

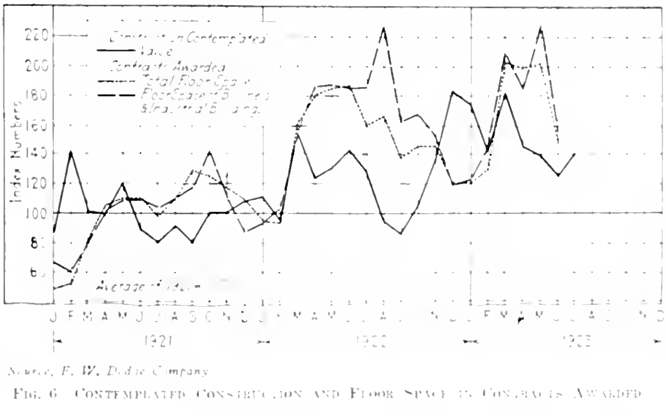
An examination of the statistics covering the period from 1920 to date shows that in only five months of this period did contemplated construction exceed the total for July. Therefore, despite the persistency of labor troubles and the high level of construction costs, and inasmuch as the figures for July are only 12 per cent below the peak reached in December last, it would seem that the demand for more floor space is still strong.

Floor space. Contracts awarded for new floor space in July showed a decline of 15 per cent from the previous month, which compares with a decline [illegible] It will be remembered that, during the war, residential and business building practically ceased while industrial building, although somewhat restricted, went ahead.

During the first six months of 1923 contracts for new floor space were awarded amounting to approximately 85 per cent of the total for the year 1921, and if the figures for July bear out the usual relationship between contemplated construction and contracts awarded the total for the seven months will exceed the total for 1921. While the total volume of construction started during the first seven months of 1923 exceeds that for the same period of 1922 by 4 per cent, it is doubtful, in view of general business and industrial conditions, if this lead will be maintained throughout the year.

Outlook. The greatest degree of stabilization in construction work is to be found in the eastern sections of the country. There has recently been a stronger tendency towards a diminution of building activity in the western and southern sections. Even with the uncertainty of the future of building construction at the present time, 1923 bids well towards adding more floor space in buildings than any other year has done.

Costs. Building material prices during July remained fairly stable, with some signs of softening slightly. Wage levels continued firm with wage raises exceeding decreases. Labor cost today is without doubt one of the most serious problems confronting the builders and one which at least calls for stabilization if construction is to be maintained at its present high level.

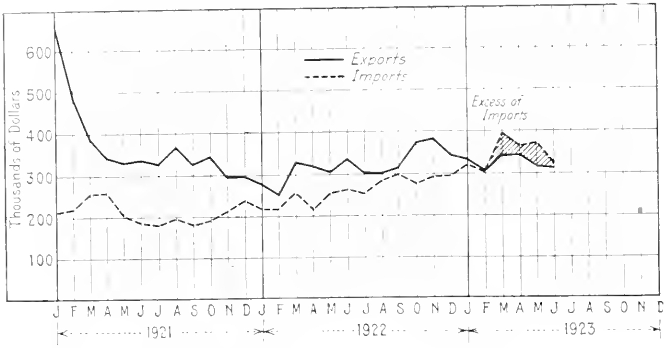


Source, F. W. Dodge Company

FIG. 6 CONTEMPLATED CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

Trend of Trade and Finance

Business Less Active: Money Rate Easier



Source, U. S. Department of Commerce

FIG. 7 FOREIGN TRADE OF THE UNITED STATES

Exports and Imports

No final figures are yet out on exports and imports for July. A government revision of the June data, however, shows a decrease in both exports and imports as originally reported. The result is a continuation of our so-called unfavorable balance of trade. June exports were $320,054,247, and June imports were $320,257,030. Fig. 7 has been corrected to show the revised data. The estimates for July indicate a slight favorable balance of trade. Exports are placed at $310,000,000 and imports at $284,000,000.

New York Stock Exchange

On the average the price of stocks on the New York Stock Exchange has held fairly firm during the month ended August 15th, but was slightly lower at the end of that period than at the middle of July. The decline came chiefly in the shape of a sharp break in the last week of July. The volume of shares traded has shown some tendency to increase, but was smaller in the week ending August 14 on account of the effect of closing due to the death of President Harding. (See Fig. 8).

Conclusion. It seems reasonable to say that the period of liquidation is completed, but that there is not much probability of any general advance in stocks before the middle of September. (This should not be interpreted as a prediction that stocks will advance on that date.)

Bank Debits and Postal Receipts

It is clearly evident from Fig. 9 that during July business activity declined. This is shown by the decrease which occurred both in bank debits to individual accounts, and in post office receipts at 50 large cities. Both fell off to a similar extent:

1921	Bank Debits	Post Office Receipts
Monthly Avg.	100	100
July 1922	111.8	112.3
June 1923	121.8	120.3
July 1923	120.0	118.0

Bank clearings fell during July. The aggregate for the month was about 8 per cent under June and about equal to July 1922. Clearings outside of New York City made a somewhat stronger showing.

Conclusions. It may be concluded that *general business activity in July was about 7 per cent above a year ago and about 20 per cent over the average of 1921, but that it has fallen off about 5 per cent from the recent high levels and is still tending downward.* It is to be remembered that allowance has been made for normal seasonal variation, and that accordingly the trends shown are very significant—especially in the case of bank debits. Of course, the movement of prices affects the amount of bank debits, and a part of the recent decline is caused by the drop in wholesale prices.

Retail Trade

The volume of retail sales for the month of July in the mail order houses, chain stores, and department stores, held up satisfactorily. Although sales for July in each class of store were less than in the previous month, the decline was actually less than was experienced during the mid-summer months of 1921 and 1922. (See Fig. 10).

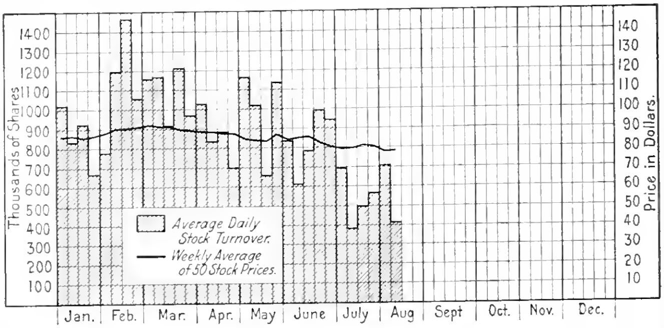
Some of this increase in sales value can be traced to higher retail prices but the greater part is due to a larger volume of goods flowing into the hands of consumers.

Conclusions. Notwithstanding the decline in volume of retail trade in recent months, and the tendency for industry to hesitate, the facts point to a greater volume of retail distribution for the year 1923 than has yet been experienced. There is no sign of a "buyers' strike."

Prices and Interest Rates

During July the downward trend of wholesale commodity prices, as shown in Fig. 11, continued at approximately the same rate as the declines of the preceding months. Bradstreet's index as of August 1st was down 2 per cent and our six-commodity index of the average for July was down 5 per cent from the preceding month.

1921	Bradstreet's Index	6-Commodity Index
Monthly Avg. ..	100	100
July 1922	105.5	118.1
June 1923	114.3	125.0
July 1923	112.0	118.0



Source, New York Times

FIG. 8 STOCK TURNOVER AND PRICES ON NEW YORK STOCK EXCHANGE FOR 1923

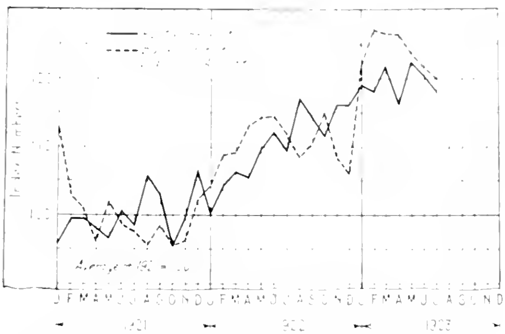


Fig. 9 Bank Debits and Postal Receipts
Both curves corrected for seasonal variations.

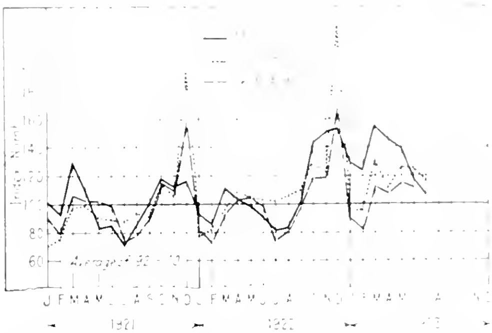


Fig. 10 Sales of Mail Order, Chain and Department Stores
2 Mail order houses; 4 chain stores; 306 department stores.

The decline in prices continues to be pretty general. In Bradstreet's list 20 articles advanced, while 47 remained unchanged and 39 declined. All six of the commodities in our special index average lower. The absolute amount of the decline in Bradstreet's, however, was not so great as in the preceding month and it shows that wholesale prices are still about 47 per cent higher than on August 1, 1914.

Prof. Fisher's weekly price index for the week ending August 10 stood at the same level as that for the week ending July 13, and had remained stationary for three weeks.

Interest. The interest rate curve also declined in July, after allowing for seasonal variation. A sharp decline in prices is apt to cause a fall in interest rates and if the downward trend of prices continues, easier money may be expected. At present, little change in money rates is in sight.

Failures and New Business Enterprises

Failures. Fig. 12 shows the trend in the business mortality and birthrate. During July the number of business failures declined in spite of falling prices and diminished volume of trade. Since seasonal variation has been eliminated, the July decline in failures is unusually significant.

New enterprises. On the other hand, new enterprises incorporated having an authorized capitalization of over $1,000,000 also showed a decline, even after allowing for seasonal variation. The capitalization of new oil concerns continued to fall off while shipping and chemical concerns continued in larger volume. As in June, the number of mortgage and loan concerns was notable.

Conclusions. While the decreased volume of new incorporations may be taken to indicate a diminished hopefulness concerning the immediate future, the point to be stressed is that the smaller number of failures indicates a relatively sound condition in business. Business failures in July were the smallest in number for any month since November 1920. Evidently business organizations everywhere had taken in sail and were, therefore, not caught by the current recession in such a way as to cause failures. *This is a strong indication that nothing approaching an acute crisis is at hand and it may be said with much confidence that as long as business failures remain so nearly normal, this conclusion holds.*

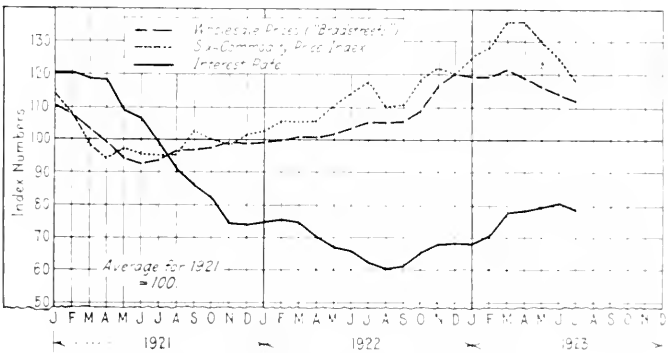
The drop in new enterprises may prove to be a mere minor fluctuation.

Bank Credit

No material change has occurred in the banking field during the last six weeks. On the whole the money market has been quiet owing to a suspension of activity in the security markets. Loans and discounts of the 771 reporting member banks of the Federal Reserve System in the last week of July declined less than 1 per cent from the June figure and the reserve ratio of the reserve banks remained at practically the same level of a month ago, with a fractional decline after allowing for seasonal variation.

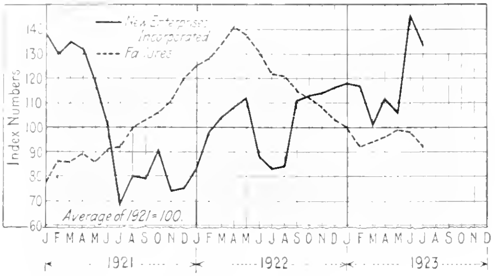
Within the reserve system there has been some shifting of position in loans and discounts as compared with a month ago. Increases in loans in the western districts were offset by decreases in the eastern sections. Loans and discounts of the 771 banks are 9 per cent greater than a year ago at this time.

Conclusion. The comparative increase in the use of funds by industry and commerce is graphically shown in Fig. 13. In view of the present state of industry and commerce no material increase in the demand for assistance from the banks is looked for.



Sources, Commercial and Financial Chronicle, Federal Reserve Board

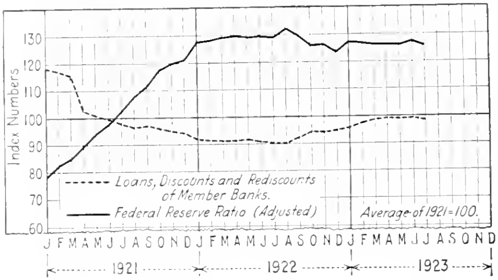
Fig. 11 Wholesale Prices and Interest Rate
Interest rate—monthly average, corrected for seasonal variation.



Sources, Dun's Review; N. Y. Journal of Commerce

FIG. 12 BUSINESS FAILURES AND NEW ENTERPRISES

Adjusted for seasonal variation; 3 months moving average.



Source, Federal Reserve Board

FIG. 13 BANK CREDIT AND FEDERAL RESERVE RATIO

Federal Reserve Ratio is ratio of total reserves to note and deposit liabilities.

Wage and Employment Situation

Wages at Peak: Labor Shortage Less Acute

Earnings and the Cost of Living

One of the most significant developments during recent months is shown by the curves in Fig. 14. Average weekly earnings of labor increased sharply up through May. In June, however, it may be said that this advance was checked. There was an increase, but it was at a much less rapid rate than during the preceding months. This clearly shows the decreased activity in industry which, as usual, is somewhat slow in manifesting itself in wages. On the other hand, the cost of living index of the National Industrial Conference Board for June showed a slight decline.

Marked check to weekly earnings. The checking of the increase in the weekly earnings of labor has been most notable in the case of New York factory workers. In this case seasonal variation has been eliminated from our curve. The increase from May to June was small, the index numbers for the two months being 107.9 and 108.2, respectively. (The average for 1921 = 100). New York factory earnings are about 8 per cent over the average for 1921 and over 11 per cent higher than in June of last year. The curve of weekly earnings for the United States, which does not allow for seasonal variation, decreased, our index falling from 111.1 to 110.4 (monthly average for 1921 = 100). It is now over 10 per cent higher than the average for 1921, and approximately 16 per cent above June a year ago.

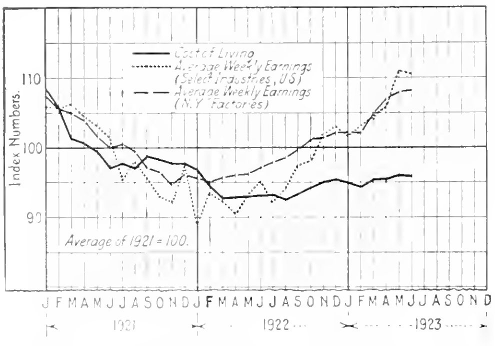
The cost of living index in June dropped about 0.2 of one per cent and was approximately 4 per cent under the average for 1921.

Conclusions. It is likely that there will be a further decrease in the average weekly earnings shown for selected industries throughout the United States. Apparently wages are very near the peak. It is to be noted, however, that the apparent *net* earnings of laborers actually increased in June, since weekly earnings advanced while cost of living at least did not increase. It is still one of the most important industrial phenomena of the time that the earnings of labor are so high relatively to cost of living when comparison is made with 1921 or 1922.

Wage purchasing power in New York. The New York University Bureau of Business Research computes each month an index number of consumer purchasing power covering New York state. For July this index was 122 in comparison with the June index of 124.3. We may conclude that in New York purchasing power is 22 per cent higher than on the average in 1921, but that it declined nearly 2 per cent in July as compared with June. An increase in the indicated purchasing power of wage earners was more than offset by decreases in agricultural and other classes.

The Employment Trend

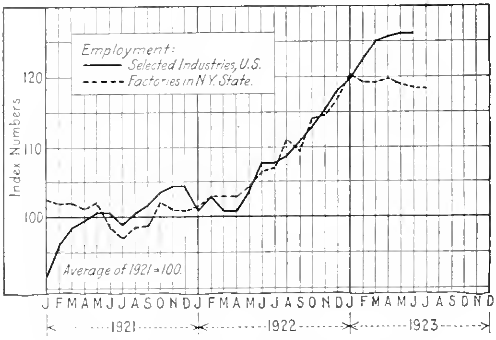
The latest available final data are for the month of June and are shown in Fig. 15. The curve indicating the trend



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; National Industrial Conference Board

FIG. 14 WAGES AND COST OF LIVING

New York factories curve corrected for seasonal variations.



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor

FIG. 15 THE TREND OF EMPLOYMENT

New York curve corrected for seasonal variations.

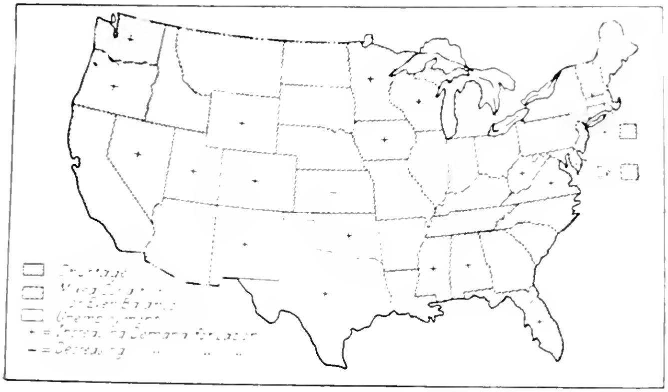
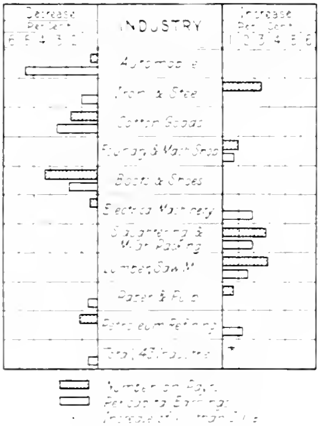


FIG. 16 CONDITION OF EMPLOYMENT BY STATES, JUNE 1923

of employment in selected industries throughout the United States remains unchanged, while employment in New York factories increased slightly.

Labor demand checked. The outstanding fact is that the increase in demand for labor, taken as a whole, has apparently been checked; and there is a continued falling off in the demand for labor in eastern factories, after allowing for the normal seasonal employment. The level of employment, however, remains much higher than a year ago. In New York factories it is over 11 per cent above 1922, and throughout the United States about 17 per cent greater.

Conclusion. The foregoing facts indicate that the peak of the labor shortage of recent months has been passed. It seems rather likely that July figures will show a decline for the United States as a whole.



Source, Bureau of Labor Statistics

FIG. 17 TREND OF EMPLOYMENT AND EARNINGS, JUNE 1923

Employment Map

The general employment map, Fig. 16, shows that there are still some areas in which labor shortage exists and also some areas of surplus labor. The most notable change from May is that there are fewer states in which the demand for labor is increasing or shortage becoming more acute. Apparently a tendency to decreased demand for labor exists in the tier of states from North Dakota to Nebraska.

Analysis of conditions. States which have swung from shortage to a balanced or mixed condition between May and June include California, South Dakota and Ohio. States in June reporting a shortage instead of the May balanced condition are Washington and Oregon, Massachusetts and New Hampshire. The unemployment section is unchanged and takes in the central southern group of states—Oklahoma, Texas and Nevada.

Trend in Selected Industries

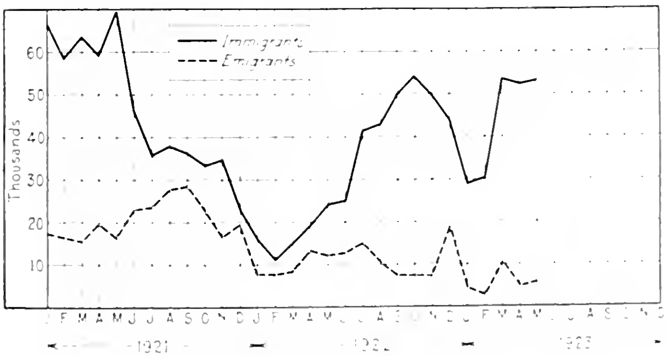
Fig. 17 [illegible] for May. [illegible] number of employees and per capita earnings were [illegible] June, however, the decreases were as numerous as the increases and almost as large in relative value.

The cotton goods and boots and shoe industries show the greatest percentage decreases in the number on the payroll, 1.7 and 3.3 respectively. The automobile, cotton goods and boots and shoes industries register decline in wage earning percentages, namely 4.6, 2.6 and 1.8. The greatest variation between the two months occurs in the wage earnings in the iron and steel industries, which dropped from a 10.9 per cent increase in May to a 1 per cent decrease in June.

Conclusions. The fact that total employment fell off from an increase of 0.3 of one per cent to an increase of less than 0.1 of one per cent in the period covered by the two months and the percentage increase of total earnings fell off from 3.8 in May to a decrease of 0.6 per cent in June quite clearly indicates that for the present the employment peak has probably been reached while earnings cannot be expected to advance but rather will tend to remain stationary or decline.

Immigration and Emigration

The data on immigration are not recent, the latest available figures being for May. In that month the number of immigrants was 52,809, this being but little change from the preceding two months. The net increase in population through immigration was 47,057.



Source, United States Bureau of Immigration

FIG. 18 IMMIGRATION AND EMIGRATION

CURRENT BOOK REVIEWS

Preparing Supports for Machinery

MACHINERY FOUNDATIONS AND ERECTION. *By Terrell Croft. 690 pp. McGraw-Hill Book Company.*

REVIEWED BY ROBERT P. KING

Works Engineer, Westinghouse Electric and Manufacturing Company

Class Number
621.715 Machinery Foundations

A VERY complete and practical presentation of the various problems met in preparing proper supports for machinery is given in this volume, and the liberal use of pictures (with plenty of explanatory dimensions and notes) makes the text simple and clear to the average reader. The fundamental principles are treated with sufficient mathematical analysis and compiled data to permit computation of the specific cases treated later in the book, allowing the latter to be studied from the standpoint of the particular type of machine under consideration, with its special needs and limitations indicated. This results in a clearer and less complicated discussion of such topics as "Steam Turbines," "Electrical Machinery," "Forging Hammers," etc.

Concrete foundations very properly have the most attention, due to the increasing use of concrete instead of stone or brick. Excavation, forms, and the pouring of concrete are thoroughly handled. Perhaps more stress should be laid on the necessity for tamping or puddling before pouring, particularly in loose soil or sand, in order to prevent settling after the foundation has been put into use.

Anchor bolts and their various accessories are described very completely, with many practical hints for special cases. In suggesting means for lengthening old bolts, or otherwise changing the metal parts of an existing foundation (Divisions 2 and 10) the author overlooks, however, the use of acetylene or arc welding, which is a great time- and money-saver over hand cutting or threading, particularly with large bolts or in a tight place.

Division 3 treats very briefly of "Electrolytic Corrosion," citing one series of tests conducted to determine the preventive action of various paints. The author concludes that no paint will permanently insulate the bolt sufficiently to prevent electrolysis, but does not give the treatment which will do so:

1. Waterproof the concrete as thoroughly as possible.
2. Provide a good metallic bond for all metal elements of the foundation (bolts, bedplates, etc.) and ground the whole metal circuit electrically.

This is particularly important for electrical machinery, and is advised from a safety standpoint on page 501 (Division 15—on "Electrical-Machinery Foundations").

The discussion of "Electrical-Machinery Foundations" (Division 15) is thorough, covering most types of equipment likely to be met. The necessity for insuring good ventilation and freedom from vibration is mentioned, and reasons are given. Possibly another important consideration might be added, which applies to many other kinds of machines as well—to practically all those equipped with shafts or pistons—leaving enough space around the completed equipment to allow easy access for cleaning or repairs. Some machine tool builders might apply such principles to good advantage in providing for motor attachment.

In the chapter on "Steam Boiler Foundations"—Division 13—designs for boiler supports are given, with several practical examples. It is interesting to note that the "three-point suspension" advocated on page 479 is compulsory in some states (Massachusetts for example) on all new work.

In general, this book handles quite satisfactorily a subject on which very little thorough analysis has been attempted until now. It is specific and simple enough to be practical, and yet provides the necessary theoretical treatment as a groundwork for intelligent design.

Employment Statistics and Industrial Cycles

CYCLES OF UNEMPLOYMENT. *By William A. Berridge. 87 pp. Houghton Mifflin Company.*

REVIEWED BY W. RANDOLPH BURGESS

Chief of Division of Reports, Federal Reserve Bank of New York

Class Number
331.1 (001) Unemployment Statistics

THIS study by Dr. Berridge, formerly Instructor at Harvard and now Assistant Professor of Economics at Brown University, was selected for the first prize of $1000 from 200 economic essays submitted to the Pollak Foundation in 1921. The study is contained in a book of less than 100 pages, printed in large type, and illustrated by diagrams. It is a clear and readable account of a careful piece of work in the statistics of employment.

The author first canvasses the available figures for workers employed in manufacturing industries as reported by state agencies for New York, Massachusetts, New Jersey, and Wisconsin, and as reported by the United States Bureau of Labor Statistics for representative establishments in the United States as a whole. He then computes an index of employment by combining figures reported by the New York State Department of Labor with those reported by the Bureau of Labor Statistics for the years from 1914 to 1922. The comparison of these figures with the data for other states, and a critical examination of their scope indicate that the index so prepared is reasonably typical of employment conditions in manufacturing establishments throughout the country. For the years previous to 1914, a monthly index is constructed from the New York, Massachusetts, and New Jersey figures. A comparison is then made between these indexes of employment and available index numbers for pig iron production, manufacturing, and general business conditions, and conclusions are drawn as to the value of the employment index.

The book is the most comprehensive presentation of the current statistics of employment which the writer of this review has seen. Some of the work goes over ground which has already previously been covered. For example, Dr. Berridge would have done well at least to mention the excellent continuous index of employment in manufacturing industries in Massachusetts from 1889 to 1921, published by Dr. Ralph G. Hurlin, in *The Annalist* in October 1921. Dr. Berridge's treatment of the available data in terms of deviations from trend is new, however, and his bringing together of all the data within the compass of a single essay is valuable.

One may question certain of the conclusions which Dr. Berridge draws as to the usefulness of his index and particularly as to the relation between production and employment.

Early in the book Dr. Berridge cites four uses for his employment index:

1. Reflecting the state of the labor market.
2. Indicating the course of production.
3. Measuring buying power.
4. Serving as an index of social welfare.

Now the fact is that in the past year and a half the index computed by Dr. Berridge has proved of limited value for any one of these four purposes. There is now a serious labor shortage in this country, production is close to the present attainable maximum, the purchasing power of the wage-earner is exceptionally large, but the two indexes of employment used by Dr. Berridge, those for New York state and the United States are 10 to 15 per cent below the 1918 or 1920 high points. There is a spread of 15 to 30 points (depending upon the indexes used) between indexes of production and factory employment. Dr. Berridge's statement that "employment yields a highly satisfactory index of industrial cycles both before and since the war" is far from true at the present time.

There are probably two main reasons why Dr. Berridge's index numbers for employment do not live up fully to the demands which he has made upon them. In the first place there has been a marked increase in the past two years in the factory output per worker which has made it possible for production to increase faster than employment. In the second place Dr. Berridge's figures are for factory workers only. They do not take account of the exceptionally large numbers of workers now engaged in building construction and other occupations outside of manufacturing. Before employment figures can yield a closely accurate measure of the labor market, or the social welfare of the population they will have to be extended to cover a much wider scope.

Dr. Berridge has given us a more adequate background against which we may view current indices of factory employment. Further critical statistical work, of the type Dr. Berridge has done, together with a more comprehensive collection of original data, is required before completely satisfactory conclusions as to industrial and social changes can be drawn from employment statistics.

A Broad View of Applied Economics

INDUSTRIAL ORGANIZATION. *By Malcolm Keir. [illegible] pp. The Ronald Press Company.*

REVIEWED BY JOSEPH W. ROE

Professor of Industrial Engineering, New York University

THE title of this book has at least two general meanings. One covers the organization of a specific business, its functions, and their relation to each other, its officials and the lines of authority uniting them. The other covers the broader activities and relationships involved in the general problem of drawing our supplies from earth, air, and water, and delivering them on the breakfast table and in the "gas" tank of the family car.

Professor Keir's book deals with the latter phase. As he points out, in a primitive or pioneer society the supply problem may be hard but it is relatively simple. Only the fundamental needs—food, fuel, shelter and clothing—are present, and these may be provided by the members of a single family. The increasing complexity of modern civilized life has created innumerable needs. A thousand persons scattered half-way around the world now contribute to the everyday life of every child. Out of the more than 105 millions of men, women, and children in the country, more than 40 millions are at work somewhere in the broad field of industry. In forest and city, night and day, in every conceivable activity, this army, vaster by far than any of war, is at work without any Supreme Command. While single units may be highly organized, such as the petroleum industry under the Standard Oil Company, other industries, such as farming, are almost wholly lacking in organization. Many firms or localities may be competing in the same industry. Different industries compete with each other, such as coal, gas, and water-power, or railway and water-transportation. In spite of conspicuous examples of business organization, the general impression is one of heterogeneity rather than unity, and wasteful competition rather than co-operation. But this very competition is our chief source of progress, and the possible rewards it offers have been the incentives which have brought about the marvelous industrial development of the last century and a half. During that time man has made greater material progress and obtained a greater command of the forces and materials of nature than in all the centuries before.

This has not been won without cost. The very agencies such as the factory system and the use of machines, which have made it possible, have brought crying evils so great that some, with their eyes only on them, would abolish the whole system regardless of whether the benefits might not go along with them.

The great problem of modern civilization is to develop some way of securing the benefits of individual initiative and competitive exchange and at the same time promoting the welfare of all. This is the field of applied economics, a science which has left the library and is now ranging far, since it must take into consideration geography, agriculture, finance, transportation, engineering, social science, and industrial relations. Professor Keir's book reflects this widening viewpoint. It aims to set forth in an elementary way "the complex industrial order by which the ordinary routine day-by-day necessaries of life reach consumers" and "to supply the background of facts about our industrial organization."

The first seven chapters give a digest of the economic geography of the United States covering the highlands and lowlands, with their climate and productive characteristics, the economics of the agricultural, mining and mineral industries, forest resources and the organization of our raw material markets.

It then takes up the development and location of the manufacturing industries and the history of our market for manufactured products: first the Yankee peddler, then the merchants, wholesalers, middlemen and jobbers, and the development of retailing from the back-woods general store to the city department store and the great mail-order houses. Up to about 1880 we had, in general, a seller's market; the demand was greater than the supply. They were comparatively easy-going days, and there was room for all. Gradually, however, we had built up a productive capacity equal to or greater than the demand, and from about 1880 on we find American manufacturers competing more sharply than theretofore, with widespread national advertising, direct sale to consumers, and the beginning of a struggle for foreign markets.

The increasing facilities for transportation had a vital part in the widening of the market—in fact, were almost the cause of it. The book therefore takes up the origin and growth of transportation on highways, waterways, and railways.

Two chapters are given to the labor problem which, in the mind of the reviewer, is not enough. Furthermore, "in order to show where and how labor fits into our national industrial mechanism" he has "chosen organized labor as representative of all labor." He admits that only 10 per cent of all the persons gainfully employed in the United States are union members, but justifies his limitation on the ground that "the relatively small membership is recruited from the occupations that are most intimately connected with the most significant industrial matters."

Great bodies of our workers have never been organized and by the nature of their occupations probably never will be. Their welfare is quite as important as that of the organized workers, who, in some industries at least, are quite able to take care of themselves; and the status of these unorganized workers merits consideration in this book. Unionism with all its faults has been a force for progress, but it is not the only one or even necessarily the best one. The newer forms of industrial representation have shown equal or greater possibilities of usefulness and these are hardly mentioned. What Professor Keir does say is good, and, in the main, fair. His sin is one of omission rather than commission. We do not agree with him, however, as to "constriction of opportunity." There is as much or more opportunity for advancement today as there ever was. The development of machinery has made possible the performance of skilled work by unskilled labor and at the same time increased the demand for skilled labor. It has helped the unskilled without injuring the skilled worker, except in some cases temporarily.

The last seven chapters are given to the vital part which money, credit, and banking play in the industrial organization, to the various forms of industrial ownership, and, to the relation of the state to industrial enterprises.

The book is intended as an introduction to economics, a study which many find difficult and uninteresting because they lack knowledge of the subject matter with which it deals. Professor Keir seeks in his book to present, for the student, a general picture of the problem which economics attacks. It will be useful also to anyone specializing in one of the phases of the industrial problem, to give him a broader view of the relationship of his own activities to the problem as a whole.

Factors of National Well-Being

The Standard of Living. *By Newel Howland Comish. 340 pp. The Macmillan Company.*

Reviewed by Bailey B. Burritt

General Director, New York Association for Improving the Condition of the Poor

Class Number
331.83 Standard of Living

Public health and the conveniences and comforts that make life enjoyable and really worth while are all tied up so intimately with the problem of the standard of living that any volume contributing to a more general understanding of the factors involved in a satisfactory rational standard of living makes a real contribution to public well-being.

Professor Comish has approached the problem from the point of view of the various factors of consumption as they are related to the standard of living. The volume is intended for the general reader and is, therefore, rather more popular than critical. It discusses the psychological factors controlling consumption, the general aims of consumption, the standards of consumption as they are affected by income and by costs of goods consumed, the detail of the minimum budget expenditures consistent with health and decency, and it points out the essentials of an "efficient standard of living."

National well-being as affected by natural resources, climatic conditions and growth of population, is considered, and the whole discussion leads up to the noting of practical considerations affecting the permanent maintenance of a satisfactory standard of living. First among these is the limitation of natural resources themselves in the face of so rapidly increasing population. Education and the improved knowledge, skill and inventive genius which go with this may overcome in part, but only in part, this natural limitation. The further elimination of present wastes of consumption may help appreciably. He suggests the limitation of population through preventing immigration and through cutting down the birth rate by postponing marriage, etc. At any rate he concludes: "Fewer people living on a high plane may be more desirable, more useful than a larger number of people living in poverty. Quality is quite as important as quantity."

Part II of the volume is devoted to such factors as the place of the middleman, direct buying, co-operative buying, consumptive credit, savings and investments and the part they play in consumption.

This book should have a wide reading, not so much by students of economics as by that wide group of persons who have not the time to address themselves to a comprehensive study of the problems of economics and of the standards of living, but who are desirous nevertheless of being intelligent about the elements of these problems as affecting individual, national and world-wide well-being. To the careful student of public welfare problems, the relation of an "efficient standard of living" to the elimination of disease and to general well-being seems inadequately presented. Similarly, the fundamental problems of permanently maintaining an "efficient standard of living" are not presented with as much evidence of conclusions based on a searching, clear-cut consideration of these problems as it would seem that they might be, even in the brief space allotted to this. The part dealing with savings and investments might also have been treated more comprehensively in the same space. The volume as a whole, however, is readable and informing and should be very helpful in stimulating a wider understanding of the problems of a decent standard of living.

Increasing Use and Values of Ratios

FINANCIAL AND OPERATING RATIOS AND MANAGEMENT. *By James H. Bliss. 396 pp. The Ronald Press Company.*

REVIEWED BY GEORGE S. ARMSTRONG

Consulting Industrial Engineer

Class Number
658:657 Management.
Accounting.

OPINION of a book such as "Financial and Operating Ratios and Management" is likely to be more a reflection of the reader's viewpoint and training than a detached appreciation of the technical merit and intrinsic value of the volume itself. It is therefore quite possible that some would regard Mr. Bliss's subject as a language as strange and meaningless as Sanskrit, while others who have been engaged in the constructive aspects of modern accounting would realize that the author has been a co-laborer in an advanced field, and has rendered a distinct service in reducing his ideas to print and coupling them with the exhaustive and labor[illegible] that which has been included in this volume.

For some time it has been recognized [illegible] balance sheet and income statement [illegible] ing by that a mere mechanical a[illegible] transactions, as expressed in the accounts, was extremely limited in value, and that constructive possibilities in the way of interpretative deductions were not adequately realized. It was this condition which focused many minds on the matter of ratios or significant interrelationships between certain items on the income statement and the balance sheet, which would convey a truer perspective of a company's vicissitudes and successes than a mere statistical tabulation such as a balance sheet, or for that matter, an income statement.

Ratios are of extreme value, and while as intimated in the introduction of this review, they may be a new language to many, nevertheless they are a coming feature of business practice and understanding, and represent a definite advance in the determination of the characteristics, status, and tendencies within individual companies and in industries as well.

This volume is not notable for any transcendent presentation of the subject, nor great originality in detail or principle, but in the clear enunciation of the subject and invaluable reference tables which are contained the volume is a real pioneer, and as such deserves to be recognized along with the previous efforts of Alexander Wall. The volume shows clearly that the author has had a ripened experience in business procedure, for it is scaled on broad lines and is permeated with fundamental understanding. The work on the whole is such a satisfactory contribution to business literature, it is to be regretted that the author's style with such a dynamic subject has not been a little more forceful. Attention to frequently invaluable business axioms is not as firmly drawn as would be the case with a more emphatic style.

The volume is divided into two parts. The first, constitutes more than half the book, is devoted to principles, and is supported by statistics only where they are necessary to illuminate the principle. The author classifies the ratios into:

Measures of Earnings.
Measures of Costs and Expenses.
Turnovers and Financial Relationships.

Later he expands this classification into the separate ratios included.

The relationships between surplus net profits on sales and surplus net profits on net worth are of great organic significance. They portray as do no other figures the characteristics of a given industry and the proportionate success of a given company operating in that industry. The other ratios such as the turnover of inventories, accounts receivable, fixed property investment, etc., while important, are of subordinate value compared with the foregoing. But the author has admirably presented all of them, and is so conversant with the subject that there appears to be little ground for controversy with either his treatment or his facts. He has recognized limitations and has qualified his findings accordingly wherever such limitations existed.

The latter part of the book contains tables which have been devised in accordance with the principles presented in the first part. These tables represent an inestimable amount of labor, and constitute a statistical treasure which now becomes available for public use merely for the price of the book. This is indeed a noteworthy service to better business.

Practical Studies in Commercial Credits

THE MECHANISM OF COMMERCIAL CREDIT. *By W. H. Steiner. 375 pp. D. Appleton and Company.*

MERCANTILE CREDITS. *By Finley H. McAdow. 200 pp. The Ronald Press Company.*

REVIEWED BY FRANK GREENE

Managing Editor, Bradstreet's

DR. STEINER'S book is aimed at business men, bankers, and students, as well as at credit men. It analyzes the commercial credit system, giving in cross-section the chief stages in the economic process through which products enter into consumption. Each stage of this process, such as extraction, manufacture, wholesale and retail trading, has well-defined credit relations with the other stages which impinge upon it in the course of the process.

The forces governing the terms of sale of products which are to be paid for in the future are considered in an informing fashion. The author reaches the conclusion that the length of the net terms in any stage and the buyer's marketing period are but a reflection of what may be termed the consumptive period for the particular article in question.

As Dr. Steiner points out, both the consumption period and the marketing period vary with the nature of the particular article. In this connection he discusses various conditions affecting the length of net terms, together with problems relating to datings, cost, and trade discounts, and terms in relation to business conditions.

In the second part of the book Dr. Steiner gives an enlightening historical account of the trade acceptance movement in the United States. He states there is a distinct tendency away from indiscriminate use of this instrument, toward careful consideration of its specific fields of use and the adaptation of it to those fields. Experience, in his opinion, has proved that it is of particular service in connection with the collection of accounts.

Dr. Steiner deals in the third part of this painstaking work with actual terms in use in leading industries. The foodstuff industries are grouped under eight heads; the metal industries under seven. In addition, there are tabular statements of terms of sale which enhance the value of a work of much thorough research in an unusual field.

The writer of the other volume now before us became a credit man, as he says, in a haphazard way, but his experience of many years has been supplemented by an extended study of the subject in preparing lectures for the instruction of others in schools of commerce. As a result, Mr. McAdow's book compresses into moderate space a practical study of, and a guide to the credit man's work.

He recognizes the importance of careful study as a basis for success in credit granting. A credit manager's training must, he says, be to a large extent self-acquired, but he notes that the beginner now finds within his reach constantly increasing facilities for training which were not accessible to business men twenty or thirty years ago. Among such facilities may be classed such a volume as that by Mr. McAdow.

Starting with the premise that a credit man should have a general and somewhat accurate knowledge not only of business methods but also of general business conditions, the author points out that a more accurate judgment will be exercised by the credit man when he has a special acquaintance with the crop situation in a farming community and with production or dangers to its continuance in a manufacturing or mining district, according to the type of locality where credit is sought.

In Mr. McAdow's opinion the dispenser of credit should be a student of economics as applied to the work of his department. He should not only glance at the financial pages of the daily newspaper but should also study the weekly reviews of business conditions by mercantile agencies, and establish confidential relations with bankers so as to get an idea of the probable future of the money market in localities where credit is looked for.

The credit man must not only be thoroughly acquainted with the information accumulated in the credit file, but he should seek an opportunity to study all published matter coming to the office which has a bearing on credit subjects. All this preparation will be found of great value when it becomes necessary to make immediate decisions, as will often be the case. In brief, the credit man must be "constantly alert to recognize and grasp every item of information that has a bearing on credits."

Mr. McAdow makes an interesting analysis of the relative importance of capital, capacity, and character as assets in the credit seeker. He also directs attention to the "dictionaries or encyclopedias of credit" issued by the mercantile agencies, and estimates that in most lines of business 75 per cent of the credits are passed on the capital and credit ratings assigned by them. He refers to other sources of credit information, including property statements, and forms for use in securing such statements are given.

For a great many years credit has been an agency of potent influence in the conduct of business. Its importance as a business factor has grown steadily with the striking development of commerce and its ever-widening extent in times comparatively recent. Those members of business houses whose work has been concerned specifically with decisions as to the granting or refusal of credit, or as to its limitation, have in the main become equipped for their work through experience. But out of their practice of many years, principles have been developed whose formulation may aid younger men materially in their training in a very necessary and difficult art. To the scientific formulation of the principles of commercial credit Dr. Steiner and Mr. McAdow have, in their recently published works, made definite and valuable contributions.

Procuring and Handling Materials

STORES AND MATERIALS CONTROL. *By Madison Cartmell. 179 pp. The Ronald Press Company.*

REVIEWED BY W. C. BOWER

Assistant Member, Purchases and Stores, New York Central Lines

Class Number
658.68 Stores Systems

THIS book, which is a thoroughly workmanlike and altogether worth-while presentation of the principles underlying purchasing and storeskeeping, did something to the reviewer that very few novels or short stories can do. It kept him reading until between one and two o'clock in the morning. And even then the inclination was to go on reading instead of snatching some sleep in preparation for another day of activity in the field of "stores and materials control."

Experienced purchasing agents and storeskeepers, and particularly those whose chief training has been in the "University of Hard Knocks," are generally a little reluctant to accept the idea that the knowledge (and wisdom, too, perhaps) that they have gained on the job can be corralled and confined between the covers of a book. But Mr. Cartmell proves them all wrong. The principles of purchasing and storeskeeping are here, and stated so clearly that even the beginner can grasp them. Speaking for his own organization, the reviewer does not hesitate to say that there are scores of men in it who need to read this book. As a matter of fact, some of them have already begun to do so.

One of the latter (he happens to occupy the important position of Supervisor of Stores for the New York Central Lines), gave his reaction on the book about as follows:

> It is good stuff. The importance of a materials organization that functions properly is not realized as it should be. The effects of good or poor work in this field in connection with a railroad are a far more important factor in the costs of transportation than is generally conceded. Books like this show clearly the thought and effort now being expended in this direction by the manufacturing world.

Mr. Cartmell's attack is spirited, and his style admirably clear. A good example is the following, under "Organization of Control":

> So far as concerns the purchasing and accounting for materials, the general accounting department should be responsible for recording liabilities and assets of the concern, and the amounts due to or from outsiders, and for accounting for all distributions to be made to the general accounts [illegible] purchase [illegible] approved [illegible] writing of [illegible] products [illegible] begins with the [illegible] crediting of the customer [illegible] a remittance.
>
> To the auditing [illegible] if such a division exists, [illegible] that no mistakes have been [illegible]
>
> In a large organization the control and cost [illegible] have distinct duties and spheres of operation. [illegible] organization the functions of the two departments [illegible] occasionally merged under a control supervisor who [illegible] responsible for the correctness of the entries made on [illegible] stores records.
>
> The cost accounting department, so far as the control of materials is concerned, allocates the responsibility for all expenditures, receives stores requisitions after they have been priced and items have been issued, posts the values of these requisitions to the proper orders and accounts, distributes overhead expense to departments and burden to products, and prepares the statistical statements of costs and operations for the guidance of the management.

In Chapter III the author enumerates the main purposes of materials control as follows:

1. To keep the right quantity and qualities of materials on hand at all times.
2. To care for materials awaiting use.
3. To determine material requirements by correlating the production with the sales program.
4. To furnish cost figures of materials and supplies used in factory operations.
5. To furnish at any time statistics as to quantities on hand, on order, consumed, required, and so on.
6. To determine the value of the inventories for the purpose of preparing financial statements.

The analysis of these six purposes, following their listing given above, is full of valuable suggestions. The same may be said of the author's statements under "Advantages of Standardization" in Chapter XII, and of the whole of Chapter XIII on "Arranging and Equipping the Storesroom." This latter chapter expresses very completely the ideal practice of storeskeeping we are all trying to reach, but have thus far not attained.

Under the head of "Defects of Departmental Buying," in Chapter XX, Mr. Cartmell strikes a note that is full of meaning for our organization. We have tried both ways of buying, and the evidence is overwhelmingly on the side of concentration. Great economies have been effected since we abandoned departmental in favor of centralized purchasing.

There is more excellent material under the heading "Seven Stages of Purchasing," also in Chapter XX, but the reviewer forbears making further quotations lest his review itself assume the proportions of a book. Instead, he will conclude by going on record to the effect that Cartmell's "Stores and Materials Control" is a volume that is literally indispensable to the purchasing agent, the storeskeeper, and all who are in any way responsible for the procurement and handling of materials.

The Colloquial in Business Terminology

STANDARD BUSINESS DICTIONARY. *By Julius Spiegel. 477 pp. Standard Publishing Company.*

REVIEWED BY EDWARD J. KILDUFF

Chairman, Department of Business English, New York University School of Commerce, Accounts and Finance

Class Number
65(03) Business Dictionary

HAVE you ever desired to know what e. & o. e. means on your broker's statement? What p. p. before a signature on a letter indicates? Have you ever tried to find in your office dictionary the meaning of certificate of origin? Of certificate of damage? Of cesser clause? Of bottomry bond? Of apographic copy? Of satisfaction piece? If so, you will be interested in this book.

The "Standard Business Dictionary," by Julius Spiegel, M. C. S., Ph. D., Professor of Accounting, Wilmington University School of Commerce, Accounts and Finance, is a volume of 477 pages that contains definitions of many terms, phrases, and colloquialisms used in accounting, banking, commerce, economics, finance, foreign trade, history, law, legislation and transportation, that the business man is likely to meet, but which are not to be found in the ordinary dictionary.

According to the author:

> . . . the purpose of this book, as I have designed it, is to supply a very genuine need that has long existed, for information of a technical or professional nature, the answers to which are to be found only in widely scattered sources. In rare or isolated cases, some of this material is to be had in printed form, but in the great majority of instances, this collection of trade terms and the professional expressions and colloquialisms distinctive to a calling or vocation has never been definitely or systematically recorded.

Without doubt, Dr. Spiegel has performed a signal service by seeking out and gathering into one book the definitions of many words and expressions employed in business that usually cannot be found in the ordinary dictionary and some that probably appear in no other dictionary.

Selling Ideas to the Public

PUBLICITY. *By R. H. Wilder and K. L. Buell. 271 pp. The Ronald Press Company.*

REVIEWED BY NORTHROP CLAREY

Assistant to the President, Standard Oil Company of New Jersey

Class Number
659.1 Advertising

THIS is a manual for the use of business, civic and social service organizations, and undertakes to tell how to secure favorable public attention for an enterprise or cause.

In the opinion of the authors publicity appears to be the performance of getting an idea over to the public by whatever means—meeting or [illegible] best adopted, from magazine editorial to [illegible] parades. In the 13 chapters of 271 pages [illegible] extensively and interestingly [illegible] the [illegible] subject that when they are done little that [illegible] remains to be said.

In one or two respects the book might be [illegible] upon. For instance, in an attempt to quote [illegible] from $15 to $500 for a hypothetical and not clearly defined advisory service in publicity they jump aside [illegible] from a high-grade, abstract, analytical thesis on publicity as a science into what looks very much like "ballyhoo" for their own wares.

Also, it is clear that the authors rather look down on the advertising copy writer as a mere mechanic whereas the publicity manager stands glorified in their esteem as artist, oracle, and architect in one.

But on the whole the book is a wonderful work on that modern science which has become known as publicity, and shows a searching knowledge such as could not have been possible to any but masters of its mysteries.

One point they bring out in bold relief—and this is one of the best things in the book—is the inexplicable reticence of business men and organizers toward placing before the public some intimate glimpse of their own personalities, views, and ambitions, to the end that the public so prone to misjudge may have some chance to know that they are human beings after all and not the disembodied corporate entities that strangers picture them through the mists.

"Publicity" is a remarkable book, worth the while of any man who treasures a program that reaches beyond his own front gate.

Good and Bad Business Correspondence

THE BUSINESS LETTER. *By Carl A. Naether. [illegible] pp. D. Appleton and Company.*

REVIEWED BY JOHN MANTLE CLAPP

School of Retailing, New York University

Class Number
651.74 Business Letters

THIS is a good book with a somewhat inappropriate title. As a restatement of the principles of the business letter it can make no special claim to distinction among the many recent works professing to do the same thing. As a collection of *problems* in letter-writing, however, and of specimens of actual business letters, good and bad, it is a valuable and almost a unique contribution to the literature of the subject. Three-fourths of the 500 page volume are filled with examples and problems. The book should prove a welcome aid for either the teacher of letter-writing or the business correspondent.

The three chapters forming Part I, "The Essentials of the Business Letter," and treating the "Mission," the "Characteristics" and the "Dress" of the business letter of today, fill together only 59 pages. On the other hand, of the eight chapters of Part II, the chapter on "Letters of Personal Information," covering

"Introductions," References and Recommendations, and particularly "Applications" fills 13 pages, "Letters of Adjustment," 48 pages, "The Sales Letter," 59 pages, and "The Follow-up Letter," 92 pages. While the range of the book is not as wide as that of some other works on the subject, the topics discussed are illustrated with a fund of specific examples which is most welcome. In many instances the problems are ingeniously connected in such a way as to carry the students along in a particular correspondence.

Many of the problems are stated with great fulness, as these from the chapter on "Letters of Adjustment:"

> *No. 23.* Two weeks ago you returned from a four weeks' camping trip in the mountains. Prior to starting on this trip you asked your local Kodak Supply Shop to rent you a kodak for the period of your outing. In view of the large amount of rental for such a long period of time, the salesman advised you to buy a kodak, saying that you would have the privilege of bringing it back after your return from the mountains, should you not wish to keep it then. You finally purchased a kodak for \$15 with the understanding that you were to be allowed \$10 on it a month from date, should you wish to return it.
>
> As soon as your camping trip ended, you decided to take the kodak back to the seller for a refund of \$10. Being away from home, you were unable to do so personally, and you therefore shipped it by insured parcel post. Today you receive a letter from the Kodak Supply Shop to the effect that since their record of your purchase of the kodak does not indicate any return privilege, they will be unable to comply with your request to take it back, and are therefore holding it for your instructions.
>
> You are now asked to write the Kodak Supply Shop, reminding them of their salesman's verbal promise to accept kodak for return, within a reasonable time from date of purchase, for \$10. Enclose a duplicate copy of your purchase slip which shows the number and size of the kodak, its price, and the salesman's name. Ask for immediate adjustment.
>
> *No. 33.* As proprietor of the Kodak Supply Shop you have been handed the letter written in solution of problem 23 on page 165.
>
> The salesman who sold the kodak in question is on his vacation just now and will be back in about two weeks from date. As soon as he returns you will refer the claim to him.
>
> Write your customer accordingly.

As regards the presentation of theory, the chapter on sales follow-up letters, the longest in the book, is also much the best. It opens with some paragraphs of sound sense expressed in fresh terms, as in the following:

> He who prepares to reinforce and follow up his initial sales letter is much like the detective who, in an effort to solve a mystery, has been given a clew to work on and has been told to bring his man in dead or alive. So far as the letter writer is concerned his clew is either fresh or faint. If it is fresh, tangible, probably in the form of an inquiry, a request for further information or prices, then his task is to convert the inquirer's first interest in the goods into active buying desire for them. For this purpose he has the contents of the prospect's letter to go by; he is working on a definite "lead." In most cases, however, the letter-salesman's clew is faint in that it rests merely on the general knowledge that John Smith, whose name is on the firm's mailing list, belongs to a certain group of [illegible]

Occasionally [illegible] has presented [illegible] to the special needs [illegible] of the ordinary instructor in letter-writing [illegible] not that he has done the wrong thing [illegible] an idea which in itself may be helpful [illegible] explained quite fully enough for the purposes of his book. For example, the exercises in self-analysis on page 4, in oral composition on page 35, and the preparation of "want-ads" on page 95 may seem a bit strange to most teachers of letter-writing. A little further explanation would perhaps show more plainly their genuine utility in the letter-writer's training.

Criticism of points like these, however, does not invalidate the unique merit of this book as a quarry of specimens and problems. Without continual reminder of how the other fellow does it, the working correspondent, no matter how capable, is pretty certain sooner or later to develop mannerisms or settle into conventionality. As for the man who must teach business letter-writing to young persons not yet bearing the yoke of business responsibility, unless he has a continual supply of varied and real problems for his youngsters to work on, he is lost. Neither correspondent nor instructor can do much in the way of a systematic hunt for the needed specimens, and no man, of course, can long succeed in inventing problems that have the ring of reality. Hence the value for both instructor and correspondent of a work like Mr. Naether's, with its multitude of fresh examples and its problems manifestly drawn from life.

An Important Aspect of the Federal Reserve System

FISCAL FUNCTIONS OF THE FEDERAL RESERVE BANKS. *By John M. Chapman. 213 pp. The Ronald Press Company.*

REVIEWED BY SHEPARD MORGAN

Assistant Federal Reserve Agent, Federal Reserve Bank, New York

Class Number
332.11 Federal Reserve Banks

RECOLLECTION of the Liberty loans is still so fresh that their identification with the federal reserve banks remains vivid. The relation of the reserve banks to the Liberty loan campaigns undoubtedly introduced many Americans to a first-hand relationship with the federal reserve system. But the sale of the Liberty loans, extensive operation though it was, was only the beginning, or rather an incidental part, to the fiscal agency operations which the federal reserve banks were conducting and still conduct for the United States.

Dr. Chapman's book describes in painstaking detail the development of these fiscal agency operations and outlines the present procedure. It is a guidebook to intricate operations and is the first, perhaps, of a series of books which future economists will write about the various aspects of the federal reserve system, already a many-sided organization.

Dr. Chapman is a friendly critic. There are many passages in his book which mark him as well disposed toward the system. "In almost every way," he remarks, for example, "the federal reserve system has proved to be far superior to the old Subtreasury plan. In fact, it is difficult to see just what the results would have been had the federal reserve banks not been in operation during the war."

He is no less friendly in his adverse criticisms. Among these is the now generally accepted opinion that the discount rates of the federal reserve banks both before and after the armistice were too low, and that they tended to stimulate unduly an increase in the volume of credit and a rise in the level of commodity prices. These low rates, which have occasioned volumes of discussion, Dr. Chapman ascribes to exigencies of war finance and in large measure exempts the reserve banks and the Federal Reserve Board from responsibility for them and such results as came from them.

It is a small clause in the Federal Reserve Act which gave authority for the manifold fiscal agency operations of the federal reserve banks. The Act says that the reserve banks "when required by the Secretary of the Treasury, shall act as fiscal agents of the United States." This clause is buried in a brief section which deals with the deposit of Treasury funds and serves as the basis not only for using the reserve banks as depositaries of the United States, and as the means through which funds are transferred throughout the country as conditions dictate, but as the selling agents of its bonds, notes, and certificates, the payers of principal and interest on the public debt, and the agencies through which bonds are handled in connection with exchange of denomination, registration, conversion, etc.

In the fifth year after the close of the war such work remains very extensive. During 1922, at the Federal Reserve Bank of New York, it included the receipt or delivery of 6,387,000 individual government bonds, notes, and certificates, amounting to \$4,633,000,000, which were exchanged or converted or handled in connection with registration, and the payment of 22,685,000 individual coupons on government bonds, notes, and certificates. It involved also the sale and issue of 320,000 pieces amounting to \$1,922,000,000, and the redemption of 646,000 pieces amounting to \$1,151,000,000.

Dr. Chapman explains at length how the federal reserve banks as fiscal agents were able to handle the vast sums of money involved in the Liberty loans and in the war-time issues of certificates of indebtedness, and still maintain the stability of the money markets. This was to a considerable extent a problem of distribution and it was through the mechanism of the federal reserve system that maladjustments were prevented. "Under the old system," says Dr. Chapman, "it would have been impossible for the Treasury Department to have collected the funds [illegible] traction and disturbance in the money market [illegible] the Secretary of the Treasury to have kept the funds scattered so extensively throughout the banks."

As an introduction to his discussion of the fiscal agency operations of the reserve banks, Dr. Chapman reviews the early fiscal history of the United States and examines briefly the independent Treasury system. The history of the first and second banks of the United States is a colorful story, and it may be that limitations of space forbade a treatment which might have been entertaining. As a statement of fact the historical preliminary serves its purpose. But Dr. Chapman places himself at a disadvantage before his readers because the early pages do not give the promise that his later chapters would justify.

Three Aspects of Advertising

OUTDOOR ADVERTISING. *By Wilmot Lippincott.* [illegible] *pp. McGraw-Hill Book Company, Inc.*

ADVERTISING TO RETAILERS. *By R. L. Burdick.* [illegible] *pp. The Ronald Press Company.*

ADVERTISING FOR THE RETAILER. *By Lloyd D. Herrold.* *677 pp. D. Appleton and Company.*

IN directing the outlay of the advertising item of the annual budget, the American executive has had access to a number of good general treatises on advertising, but none of them thus far has done justice to such topics as outdoor posters, street car advertising, and electric displays. Mr. Lippincott's volume is designed to fill this gap, and does so admirably.

The author gives credit to Robert D. Whittemore of the Babson organization for the idea of the book. He is also indebted to Percival White for an unusually discriminating introduction. But perhaps his greatest debt of all is to the color printers who have made Chapter X on "Art and Color Technique" a delight not only to the actual or prospective advertiser, but to every member of his family from the oldest down to the youngest.

In fact, the illustrations of this volume, of which there are many in black as well as in color, go far toward telling the story of outdoor advertising by themselves, almost independently of the text. Scores of 24-sheet posters, displayed in cities from coast to coast, and covering a great variety of nationally advertised products, are shown. There are de luxe city bulletins, with attractive landscape gardening about them; automobile poster-boards placed so as to give the tourist more than a fleeting glance; and railroad bulletins, set well back from the tracks so as to be seen easily from a moving train.

In justice to Mr. Lippincott, it must be said that he does far more than merely provide running comment on his admirable pictures. He gives a comprehensive and well-balanced account of modern outdoor advertising, and therefore does a real service to every executive who wishes to get the best possible value out of every dollar of his advertising appropriation.

Mr. Burdick's workmanlike volume is aimed directly

at manufacturers who market their goods through the ordinary trade channels of distribution. As he points out, since the business depression of 1921-1922 many manufacturers have given increased attention to advertising specially addressed to retail distributors. In "Advertising to Retailers" he brings together for the first time in organized form the basic principles and successful practice of advertising in this field.

The book is inscribed to Jesse Harding Neal of The Associated Business Papers, Inc., with which organization Mr. Burdick is himself connected. Acknowledgment is made of the co-operation of a number of well-known advertising specialists, as well as several publishers and an economist or two for good measure.

Mr. Burdick's method of attack is well conceived. He sticks consistently to his text—how the manufacturer may and does win the active co-operation of the retail trade. He describes, and makes logical deductions from the experience of a large number of manufacturing concerns. He indicates how the appeal to the retailer is different from that made to the consumer. He shows very plainly the extent of the retailer's power to make or mar the business of the manufacturer.

The author handles adequately the various elements that go to make up the general advertising plan. He describes the process of lining up the appropriation; indicates how the special appeals are selected, how the mediums are chosen and how the copy and layout are prepared. He explains the function and usefulness of retail publications, discusses direct-mail methods and other forms of advertising to the trade. Statistics and figures in support of the various points under discussion are wisely omitted from the body of the book, and are grouped together in a special chapter at the end. Advertising manufacturers will find this a decidedly valuable book.

Mr. Herrold's work, "Advertising for the Retailer," is addressed so directly to the retail trade that a review of it in a magazine published primarily for industrial executives would appear to require a word of explanation. The simple fact is that the appeal of this book is broader than is indicated in its title. While much of the material is prepared specifically with the retail dealer in mind, there is much more that is of value to everybody who advertises, and that certainly includes the industrial executive of today.

The book was originally prepared for instruction in retail advertising for students enroled in the correspondence study department of the University of Wisconsin. In its present form it is designed to serve as a handbook for retail merchants and advertising managers in retail establishments; as a text for use in high schools, business colleges, and universities; and as a possible basis for instruction in correspondence study work.

The author's treatment of the planning of advertising campaigns and the choice of mediums is orthodox. Chapter IV, "What to Advertise," and Chapter V, "Finding the Selling Points," are full of good specific suggestions. Some of the most valuable material in the book, from the viewpoint of the executive, is that in Chapter VIII and following chapters, covering type measurements, type [illegible] each, and the display feature of advertising [illegible]

The chapters on "The Business Letter," "Writing the Sales Letter," and "Follow-up Letters" [illegible] the ordinary treatise on Business English, but the author has evidently regarded these topics as essential to a rounding out of his general theme, and from this point of view they doubtless have their value. The volume is well printed and bound, and adequately [illegible] not copiously illustrated.

WE AND OUR WORK. *By Joseph French Johnson. [illegible] pp. Boni and Liveright, Inc.*

IN this volume the American Viewpoint Society follows the text-and-picture method used in "We and Our Government" by Professors J. W. Jenks and R. D. Smith, and in "We and Our History" by Professor Albert Bushnell Hart. Evidently "visual education" is not to be left entirely to the motion-picture wing of the pedagogic army.

The publishers, in announcing this series which is frankly designed for textbook use in secondary schools, make much of the novelty of the page layout. They may well do so, for rarely if ever have textbook pages been so consistently "broken" by illustrative material in the form of halftones, line cuts, charts, tables, cartoons, maps, forms, graphs, and "boxes." The photographs seem thoroughly in keeping with the purpose of the text; the full-page drawings, fanciful marginal decorations by Hanson Booth and verses by Eddie Guest perhaps not quite so much so.

One of the best chapters, as regards both text and illustrations, is the second, called, "The Story of Industry." Three stages of plow-building, for example, are shown on one page: the primitive wooden implement, the modern steel plow, and the up-to-the-minute gang plow drawn by a tractor. The use of fire in cooking is similarly illustrated in three views: open-fire roasting by means of the spit; kettle-boiling, illustrating the use of utensils; and the modern kitchen gas or electric range, controlled by an efficient-looking young lady dietitian.

This series constitutes a very interesting pedagogical experiment. Today we stress the social studies in the secondary schools. Teachers who have been compelled to use texts "cut down" from those written for college students are undoubtedly looking anxiously for something more usable, particularly for the commercial and vocational schools and the rapidly developing junior high schools. If the "We" books are fortunately to end this puzzling quest, there are many to be congratulated—teachers, pupils, publishers and author.

ERRATUM

The attention of the editors has been called to an error in the August issue. In the review of Eugene Lyman Fiske's "Health Building and Life Extension," by Dr. R. S. Quinby of the Hood Rubber Company, the statement that "upwards of 80 days per year is lost on account of sickness among industrial workers" should read "upwards of 8 days."

MANAGEMENT DATA

Standardized Methods and Accepted Practice Classified for Permanent Reference

Number 18

COMMON MATERIALS USED IN MANUFACTURE

Class Number
620.1:389 Standard Materials Data.

THE data which follows has been collected and arranged for the use of purchasing agents, estimating and cost clerks, and others who are concerned with the commercial and accounting rather than the technical side of production. From the data on blue-prints, bills of material, stores issues, orders, and other records these men must determine kinds and quantities of material required and used for jobs as they go through the shops. Economies must be brought about in the use of such materials, unavoidable waste must be allowed for, and modification of specifications or substitution of other kinds must often be made. Frequently substitution is an advantage from the standpoints of utility, cost and rapid processing.

TABLE 1. WEIGHTS AND SPECIFIC GRAVITIES OF COMMON MATERIALS

Name	Weight per Cu. Ft. Lb.	Weight per Cu. In. Lb.	Specific Gravity (Water = 1.000)
Aluminum	166	0.096	2.670
Brass, cast (65 parts copper, 35 parts zinc)	524	0.300	8.393
Bronze	534	0.308	8.560
Copper, cast	537	0.310	8.607
Copper, wire	555	0.320	8.900
Glass	163	0.095	2.620
Iron, cast	450	0.260	7.218
Iron, wrought	485	0.280	7.700
Lead, cast	708	0.408	11.380
Lead, rolled	711	0.410	11.110
Mercury	849	0.489	13.596
Steel	490	0.284	7.854
Tin, cast	455	0.262	7.291
Wood, pine, dry	30	0.017	0.480
Zinc	437	0.252	7.000

Aluminum

This metal can be obtained in bulk for use in making castings, and in sheets, wire, pipes, and tubes.

Sheets and square and round bars are sold in the following thicknesses or diameters:

$\frac{1}{16}$ in.

$\frac{1}{8}$ in. to 1 in. by $\frac{1}{8}$ in.

1, $1\frac{1}{4}$, $1\frac{1}{2}$ and 2 in.

Wire is made in the diameters of the American or Brown and Sharpe Gage, ranging from No. 0000 (0.46 in. diam.) to No. 40 (0.00314 in. diam.)

Tubes. Seamless drawn aluminum tubes come in the sizes shown in Table 2.

TABLE 2. ALUMINUM TUBES

(Aluminum Co. of America)

Nominal Size In.	Outside Diam. In.	Inside Diam. In.	Weight per Ft. Lb.
$\frac{1}{8}$	0.405	0.270	0.083
$\frac{1}{4}$	0.540	0.364	0.145
$\frac{3}{8}$	0.675	0.494	0.193
$\frac{1}{2}$	0.840	0.623	0.290
$\frac{3}{4}$	1.050	0.824	0.387
1	1.320	1.050	0.577
$1\frac{1}{4}$	1.660	1.380	0.777
$1\frac{1}{2}$	1.900	1.610	0.928
2	2.380	2.070	1.240
$2\frac{1}{2}$	2.880	2.470	1.980
3	3.500	3.070	2.590
$3\frac{1}{2}$	4.000	3.550	3.110
4	5.000	4.030	3.690

Aluminum in the form of an alloy with copper or zinc is used for automobile and other castings; with bronze for high temperature service; with magnesium to form a strong, light, non-tarnishing metal for sand or chilled castings, sheets or stampings; and with various alloys for castings, patterns, spinning, rolling, drawing, etc.

Copper and Brass

These metals come in the form of sheets, bars, rods, tubing, pipes, wire, etc.

(Continued from p. 387)

Copper and brass sheet and plates can be obtained in thicknesses corresponding to the Brown and Sharpe Gage, No. 0000 (0.46 in.) to No. 40 (0.00314 in.). They also come in fractional thicknesses $\frac{1}{16}$ in. to 2 in. varying by $\frac{1}{16}$ in. In addition, they can be obtained rolled to weight:

$\frac{1}{8}$ lb. to $1\frac{1}{4}$ lb. per sq. ft. by $\frac{1}{8}$ lb. variations.
$1\frac{1}{2}$ lb. to 3 lb. per sq. ft. by $\frac{1}{4}$ lb. variations.
$3\frac{1}{2}$ lb. to 10 lb. per sq. ft. by $\frac{1}{2}$ lb. variations.
11 lb. to 16 lb. per sq. ft. by 1 lb. variations.

Copper and brass wire are measured by the Birmingham or Stub's Gage except when used for electrical purposes, when the Brown and Sharpe Gage is followed. Sizes in the latter system range, as usual, from No. 0000 (0.46 in. diam.) to No. 40 (0.003144 in. diam.). The Stub's Gage is going out of use.

Copper and brass bars and rods come in sizes as follows:

Copper rods, square and round
$\frac{1}{8}$ in. to 3 in. by $\frac{1}{8}$ in. variations.
Copper rods, rectangular
$\frac{1}{16}$ x $\frac{1}{2}$ in. to 1 in. by $\frac{1}{8}$ in. variations.
$\frac{1}{16}$ x $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. variations.
$\frac{1}{8}$ x $\frac{1}{2}$ in. to 1 in. by $\frac{1}{8}$ in. variations.
$\frac{1}{8}$ x $1\frac{1}{4}$ in. to 3 in. by $\frac{1}{4}$ in. variations.
$\frac{3}{16}$ and $\frac{1}{4}$ in. sizes vary the same as the $\frac{1}{8}$ in. sizes just noted.
$\frac{3}{8}$ x 1 in. to 5 in. by $\frac{1}{4}$ in. variations.
$\frac{1}{2}$ x 1 in. to 6 in. by $\frac{1}{4}$ in. variations.
$\frac{3}{4}$ and 1 in. sizes vary the same as the $\frac{1}{2}$ in. sizes just noted.
Brass bars or rods are made both round and square. The sizes range:
$\frac{1}{16}$ in. to 2 in. by $\frac{1}{16}$ in. variations.
2 in. to 3 in. by $\frac{1}{8}$ in. variations.

Brass tubes. Seamless brass tubes go by outside diameters. They are made in sizes as follows:

$\frac{1}{8}$ in. to 1 in. by $\frac{1}{16}$ in. variations.
$1\frac{1}{8}$ in. to 8 in. by $\frac{1}{8}$ in. variations.
In sizes above 2 in. the common variations are $\frac{1}{4}$ in.

Thicknesses of brass tubes vary from No. 4 to No. 26 American Wire Gage for sizes 2 in. and below, except that tubes $\frac{1}{2}$ in. and under are not made in the thicker varieties. For sizes over 2 in. the thickness varies from No. 2 to No. 24 American Wire Gage, except that the sizes $4\frac{1}{2}$ in. and larger are not made in the thinner varieties. The decimal equivalents of the American Wire Gage sizes above mentioned are:

No. 2	0.25763 in.
No. 4	0.20431 in.
No. 24	0.02010 in.
No. 26	0.01594 in.

Copper and brass pipes. The same dimensions are used for copper and brass pipes as for wrought-iron and steel pipes, and threading is done according to the wrought iron standard. Hence iron pi[illegible] be used in ordering, viz:

$\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ in. variations.
2 in. to 5 in. by $\frac{1}{2}$ in. variations.
5 in. to 10 in. by 1 in. variations.

Pipe must be differentiated from brass tubing [illegible] as is used for ornamental work, railings, etc. The tubing is too thin for pressure work and will not take the standard pipe thread.

Steel

Steel can be obtained in bulk for castings, or in the form of plate, sheets, bars, structural shapes, pipes, tubes, wire, and the like. It is made in many varieties for special purposes, viz: Tool steel, high speed steel, carbon steel, nickel steel, etc.

Steel plate comes in Universal Mill and Sheared forms. Universal Mill plates are made in thicknesses ranging from:

$\frac{1}{4}$ in. to $\frac{5}{8}$ in. by $\frac{1}{16}$ in. variations.
$\frac{5}{8}$ in. to 2 in. by $\frac{1}{8}$ in. variations.

The usual widths vary from 12 in. to 48 in. and the lengths corresponding, which are obtained by rolling, vary with the thicknesses. A manufacturer's handbook must be consulted for further details.

Sheared plates can be obtained either rectangular or circular in shape. Thicknesses vary differently with different manufacturers, the ranges being:

$\frac{3}{16}$ in. to $\frac{7}{8}$ in. by $\frac{1}{16}$ in. variations.
1 in. to $1\frac{1}{4}$ in. by $\frac{1}{8}$ in. variations.
$1\frac{1}{2}$ in. to $2\frac{1}{4}$ in. by $\frac{1}{4}$ in. variations.

The usual widths range from 24 in. to 96 in. with some makes, while others list widths as high as 132 in. Again a handbook of the manufacturer must be consulted to determine the corresponding lengths.

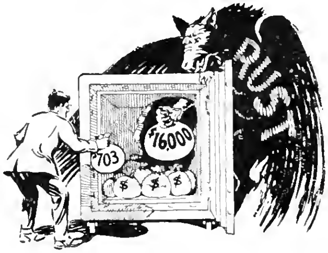
Sheet steel thickness is measured by the Birmingham Wire Gage, ranges No. 0000 (0.454 in.) to No. 36 (0.004 in.); by the Brown and Sharpe Gage, ranges No. 0000 (0.46 in.) to No. 40 (0.003144 in.); by the U. S. Standard Gage No. 0000000 (0.50 in.) to No. 38 (0.0063 in.); or by plain fractions from $\frac{1}{2}$ in. down to $\frac{1}{256}$ in. as follows:

$\frac{1}{2}$ in. down to $\frac{5}{16}$ in. by $\frac{1}{32}$ in. variations.
$\frac{19}{64}$ in. down to $\frac{1}{64}$ in. by $\frac{1}{64}$ in. variations.
$\frac{1}{128}$ in. and $\frac{1}{256}$ in.

Structural steel shapes. In many branches of manufacturing steel shapes can be used to great advantage in place of special castings or forgings. Steel shapes come in the form of I-beams, girder beams, channels, angles, T-bars, and such special forms as bulb beams, Z-bars, etc. All are sold on a pound basis. Beams and channels are ordered by depth and a definite weight per foot, and will be cut to length if desired,[1] viz: A

[1] Bethlehem Steel practice is to cut to length within the following limits:
I beams and channels (to 24 in.), $\frac{3}{8}$ in. either way.
Angles, $\frac{3}{4}$ in. over, 0 in. under length.
H and Girder beams, within $\frac{1}{2}$ in.
An extra price is charged for cutting to exact length.

Use BRASS PIPE Plumbing to Fight Corrosion



A $16,000 Lesson

In 1915, a splendid bank building was erected in Bridgeport, Connecticut.

Less than two years later the plumbing developed serious leaks, which occurred with increasing frequency till the Fall of last year, when it was completely changed over to *Brass* pipe in both the cold and hot water lines.

To make this change-over cost the bank $16,800; whereas in the first place Brass pipe could have been installed for only $703.38 over the cost of the corrodible pipe then selected.

Such costly losses are constantly occurring in buildings equipped with piping that rusts.

Always the result is the same. Rust-clogged, leaking pipes, repairs and, finally, replacement at greatly increased cost over an original installation of Brass.

Throughout your plant, in power apparatus, in much of the machinery, and as water outlet fixtures on the plumbing lines, Brass has the job of keeping out rust.

This being so, it is logical to entrust Brass with the larger work of keeping rust out of the whole water-servicing system.

Office and loft buildings, hotels, public buildings and dwellings are large consumers of Brass pipe. Architects and construction engineers have seen that Brass pipe and tubing in industrial apparatus keeps out corrosion and they have now turned to Brass to eliminate costly plumbing repairs and replacements.

Brass pipe simply cannot rust. It is the only certain way to avoid the unpleasant, expensive experience of the Bridgeport bank, described in the adjoining column.

"Brass is cheaper because you pay for it only ONCE"

COPPER & BRASS
RESEARCH ASSOCIATION
25 Broadway - New York

(Continued from p. 390)

15 in. 45 lb. I-Beam, 18 ft. 6 in. long. For angles, T-bars and Z-bars the thickness is usually specified in place of the length, viz: A 5 x 3 x 3/8 in. angle.

Complete information regarding sizes and properties of such shapes can be obtained from any of the complete handbooks put out by the various manufacturers. The attached tables, 3 to 8, show in a general the standard sizes obtainable. Tables of special sizes are contained in the handbooks but are not included here, except partially for angles.

TABLE 3. STANDARD I-BEAMS

Depth In.	Minimum Weight per Ft. Obtainable Lb.	Maximum Weight per Ft. Obtainable Lb.
3	5.50	7.50
4	7.50	10.50
5	9.75	14.75
6	12.25	17.25
7	15.00	20.00
8	18.00	25.25
9	21.00	35.00
10	25.00	40.00
12	31.50	40.00
15	42.00	60.00
18	55.00	70.00
20	65.00	75.00
24	80.00	100.00

TABLE 4. STANDARD CHANNELS

Depth In.	Minimum Weight per Ft. Obtainable Lb.	Maximum Weight per Ft. Obtainable Lb.
3	4.00	6.00
4	5.25	7.25
5	6.50	11.50
6	8.00	15.50
7	9.75	19.75
8	11.25	21.25
9	13.25	25.00
10	15.00	35.00
12	20.50	40.00
15	33.00	55.00

TABLE 5. STANDARD ANGLES EQUAL LEGS

Size In.	Minimum Thickness In.	Maximum Thickness In.	Thickness Variations In.
$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{1}{8}$	$\frac{7}{16}$	$\frac{1}{16}$
2 x 2	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{1}{16}$
$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{3}{16}$	$\frac{9}{16}$	$\frac{1}{16}$
3 x 3	$\frac{1}{4}$	$\frac{11}{16}$	$\frac{1}{16}$
$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{5}{16}$	$\frac{7}{8}$	$\frac{1}{16}$
4 x 4	$\frac{5}{16}$	$\frac{7}{8}$	$\frac{1}{16}$
6 x 6	$\frac{3}{8}$	$\frac{13}{16}$	$\frac{1}{16}$
8 x 8	$\frac{1}{2}$	$1\frac{1}{8}$	$\frac{1}{16}$

TABLE 6. SPECIAL ANGLES EQUAL LEGS

Size In.	Minimum Thickness In.	Maximum Thickness In.	Thickness Variations In.
$\frac{3}{4}$ x $\frac{3}{4}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{16}$
1 x 1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{16}$
$1\frac{1}{4}$ x $1\frac{1}{4}$	$\frac{1}{8}$	$\frac{5}{16}$	$\frac{1}{16}$
$1\frac{3}{4}$ x $1\frac{3}{4}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{1}{16}$
$2\frac{1}{4}$ x $2\frac{1}{4}$	$\frac{3}{16}$	$\frac{7}{16}$	$\frac{1}{16}$
$2\frac{3}{4}$ x $2\frac{3}{4}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{1}{16}$
5 x 5	$\frac{3}{8}$	$\frac{11}{16}$	$\frac{1}{16}$

TABLE 7. STANDARD ANGLES UNEQUAL LEGS

Size In.	Minimum Thickness In.	Maximum Thickness In.	Thickness Variations In.
$2\frac{1}{2}$ x 2	$\frac{3}{16}$	$\frac{9}{16}$	$\frac{1}{16}$
3 x $2\frac{1}{2}$	$\frac{1}{4}$	$\frac{5}{8}$	$\frac{1}{16}$
$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{16}$
$3\frac{1}{2}$ x 3	$\frac{5}{16}$	$\frac{7}{8}$	$\frac{1}{16}$
4 x 3	$\frac{5}{16}$	$\frac{7}{8}$	$\frac{1}{16}$
5 x 3	$\frac{5}{16}$	$\frac{7}{8}$	$\frac{1}{16}$
5 x $3\frac{1}{2}$	$\frac{5}{16}$	$\frac{15}{16}$	$\frac{1}{16}$
6 x $3\frac{1}{2}$	$\frac{3}{8}$	1	$\frac{1}{16}$
6 x 4	$\frac{3}{8}$	1	$\frac{1}{16}$

TABLE 8. SPECIAL ANGLES UNEQUAL LEGS

Size In.	Minimum Thickness In.	Maximum Thickness In.	Thickness Variations In.
3 x 2	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{1}{16}$
4 x $3\frac{1}{2}$	$\frac{5}{16}$	$\frac{11}{16}$	$\frac{1}{16}$
5 x 4	$\frac{3}{8}$	$\frac{11}{16}$	$\frac{1}{16}$
7 x $3\frac{1}{2}$	$\frac{7}{16}$	1	$\frac{1}{16}$
8 x 6	$\frac{1}{2}$	1	$\frac{1}{16}$

Dimensions of Girder-beams, T-bars, etc., may be obtained from steel handbooks.

Steel bars and rods are obtainable in the following sizes:

$\frac{1}{16}$ in. to $\frac{3}{4}$ in. by $\frac{1}{64}$ in. variations.
$\frac{13}{16}$ in. to 12 in. by $\frac{1}{16}$ in. variations.
As purchased, bars average in length from 16 to 20 feet.

Continued from p. [illegible]

Steel flats come in commercial sizes ranging in width from:

- $\frac{3}{4}$ in. to $2\frac{3}{4}$ in. by $\frac{1}{8}$ in. variations
- 3 in. to $7\frac{1}{2}$ in. by $\frac{1}{2}$ in. variations

The corresponding thicknesses for selected typical sizes are as follows:

WIDTH IN.	THICKNESS IN.
$\frac{3}{4}$	$\frac{1}{8}$ to $\frac{5}{8}$
1	$\frac{1}{8}$ to $\frac{[illegible]}{16}$
$1\frac{1}{2}$	$\frac{1}{8}$ to $1\frac{1}{4}$
2	$\frac{1}{8}$ to $1\frac{[illegible]}{4}$
$2\frac{1}{2}$	$\frac{3}{16}$ to $1\frac{[illegible]}{4}$
3 and above	$\frac{1}{4}$ to 2

Half rounds, ovals, round edge flats and other shapes can be obtained from stock but are used for special purposes.

Steel pipe comes in the same sizes as wrought-iron pipe. (See below.) So called outside diameter pipe takes in all regular sizes above 12 in. and is designated by outside diameter and thickness. The diameters include 14, 15, 16, 17, 18, 20, 21, 22, 24, 26, 28, and 30 in. and thicknesses range from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. by $\frac{1}{16}$ in. variations, and thence by $\frac{1}{8}$ in. variations to $1\frac{1}{8}$ in.

Spiral riveted steel pipe can be obtained in sizes varying from 12 in. to 72 in. inside diameter.

Steel tubing is made in outside diameters ranging from:

- $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. by $\frac{1}{8}$ in. variations.
- $1\frac{3}{4}$ in. to 5 in. by $\frac{1}{4}$ in. variations.
- $5\frac{1}{2}$ in.

The thinner weights go by Birmingham Wire Gage thickness, No. 20 (0.035 in.) to No. 10 (0.134 in.). The remaining thicknesses vary according to the fractional system:

- $\frac{5}{32}$ in. to $\frac{1}{4}$ in. by $\frac{1}{32}$ in. variations.
- $\frac{5}{16}$ in.
- $\frac{3}{8}$ in. to 1 in. by $\frac{1}{8}$ in. variations.

Steel wire is measured usually in the Roebling or Washburn and Moen Gage. Diameters range from No. 0000000, (7/0), or 0.49 in. to No. 40, or 0.007 in. The Stub's Iron or Birmingham Wire Gage is also used occasionally, although more often it is applied to drill rod, and for wire other than that for electrical purposes.

Cold rolled steel is used largely for shafting and comes in sizes as follows:

- $1\frac{1}{2}$ in. to 3 in. by $\frac{1}{16}$ in. variations.
- $3\frac{1}{8}$ in. to 5 in. by $\frac{1}{8}$ in. variations.

Wrought Iron

Wrought iron sheets come in the same sizes as steel sheets.

Wrought iron bars—rounds, squares and flats are obtainable in the same sizes as steel products of the same shapes.

Iron wire comes in [illegible] Brown and Sharpe Gage No. 0000 [illegible] to No. 40 (0.00314 in. diameter). [illegible] appearing from common [illegible]

Wrought iron pipe. Many uses are found for pipe besides the conveying of fluids. It is used in railings and various structures around a plant where its adaptability makes it a convenient substitute for structural shapes or castings. It can be cut to any length and threaded to make any desired combination with ells, tees, crosses, caps, laterals, and other pipe fittings. The accompanying Table 9 shows the fundamental dimensions of standard welded pipe. Extra heavy and double extra heavy pipe is obtainable but is not used in ordinary work.

TABLE 9—STANDARD WELDED WROUGHT-IRON AND STEEL PIPE.

Briggs Standard to 10 in. National Tube Co. Standard above 10 in.

SIZE IN.	NO. OF THREADS PER IN.	DIAMETER Outside In.	DIAMETER Inside In.	THICKNESS IN.	WEIGHT PER LINEAR FT., LB.
$\frac{1}{8}$	27	0.405	0.269	0.068	0.246
$\frac{1}{4}$	18	0.540	0.364	0.088	0.426
$\frac{3}{8}$	18	0.675	0.493	0.091	0.570
$\frac{1}{2}$	14	0.840	0.622	0.109	0.855
$\frac{3}{4}$	14	1.050	0.824	0.113	1.140
1	14	1.315	1.049	0.133	1.690
$1\frac{1}{4}$	$11\frac{1}{2}$	1.660	1.380	0.140	2.290
$1\frac{1}{2}$	$11\frac{1}{2}$	1.900	1.610	0.145	2.740
2	$11\frac{1}{2}$	2.375	2.067	0.154	3.690
$2\frac{1}{2}$	$11\frac{1}{2}$	2.875	2.469	0.203	5.850
3	8	3.500	3.068	0.216	7.660
$3\frac{1}{2}$	8	4.000	3.548	0.226	9.240
4	8	4.500	4.026	0.237	10.900
$4\frac{1}{2}$	8	5.000	4.506	0.247	12.700
5	8	5.563	5.047	0.258	14.900
6	8	6.625	6.065	0.280	19.200
7	8	7.625	7.023	0.301	23.800
8	8	8.625	7.981	0.322	28.900
9	8	9.625	8.941	0.342	34.300
10	8	10.750	10.020	0.365	41.200
11	8	11.750	11.000	0.375	46.100
12	8	12.750	12.000	0.375	50.900
13	8	14.000	13.250	0.375	56.100
14	8	15.000	14.250	0.375	60.700
15	8	16.000	15.250	0.375	64.900
....	....	18.000	17.250	0.375	70.600
....	....	20.000	19.250	0.375	78.600
....	....	22.000	21.250	0.375	86.600
....	....	24.000	23.250	0.375	94.600

Random lengths run from 12 or 15 ft. to 20 ft. with the average about 16 to 18 ft. Ordinary black pipe is furnished on orders unless galvanized is specified.

Wrought iron is used for many jobs because facility of bending, forging and welding makes it easier to handle than the harder varieties of steel. Moreover, its superior rust resisting qualities insure practical permanence when exposed to dampness and the weather.

Cast iron pipe and fittings are made in both flanged and bell and spigot designs from 3 in. to 60 in. diameter, and the flange variety can be obtained up to 100 in. diameter. Pipe comes in standard lengths of 12 ft. The common uses are somewhat outside of the scope of this data sheet.

MANAGEMENT AND ADMINISTRATION

FOR OFFICERS EXECUTIVES AND DIRECTORS OF INDUSTRY

MEN MATERIALS MACHINES

VOLUME VI — OCTOBER 1923 — NUMBER 4

A National Service to Industrial Managers

Rendered by the United States Bureau of Standards

By GEORGE K. BURGESS

Director, United States Bureau of Standards

IN the Department of Commerce there are three great service Bureaus—Census, Foreign and Domestic Commerce, and Standards—which have many points of contact with manufacturing and trade.[1] The Bureau of the Census, the government's principal statistical office, gathers and disseminates basic information relating to the economic progress of the country, furnishing commercial and industrial statistics dealing with agriculture, manufactures, mining, transportation, and current business conditions. The Bureau of Foreign and Domestic Commerce, with its 29 offices abroad, 33 district offices in the United States, its regional and technical groups, together with 17 commodity divisions, is concerned primarily with the promotion of export trade, but since July 1, 1923, is also engaged in the study of domestic commerce. The Bureau of Standards, likewise, has its work concentrated in highly specialized, technical divisions (see Fig. 1) devoted respectively to weights and measures, electricity, heat and power, optics, chemistry, mechanics and sound, structural and miscellaneous materials, metallurgy, ceramics, housing, simplified practice, and specifications.

The Bureau is housed in 11 permanent buildings, one of which, devoted to industrial research, contains $4\frac{1}{2}$ acres of floor space. There are also several temporary buildings for special purposes. The permanent staff is 830, of whom 513 are classed as scientific and technical. The appropriations for the current year total $1,642,360, of which nearly one-half is available for work in designated fields of research of immediate interest to industry, including a fund of $150,000 specifically allotted for problems in industrial research.

There are 5 classes of standards covered by the Bureau:

1. Standards of *measurement*, such as those relating to length, mass, temperature, electrical and optical quantities.
2. Standard *constants*, illustrated by the determination of the exact values of densities, viscosities, heat and electrical conductivities, melting and boiling points, atomic weights.
3. Standards of *quality*, with particular reference to the properties of materials required, for example, in specifications.
4. Standards of *performance*, as of instruments and machines.
5. Standards of *practice*, as used in the formulation of codes for technical regulation of construction, installation, and operation of many types of utilities and industries.

The Bureau has no police powers, and in its work relating to standardization in industry there is no coercion practiced. Industrial standards are set up

[1] See Department of Commerce publication "Trade Association Activities," 1923, Superintendent of Documents, Washington, D. C.

through co-operation with industry itself, and if a standard proposed by the Bureau is adopted by industry, it is only because the project is recognized as rational, fair to all parties concerned, meeting the required conditions, and is the best attainable for the purpose intended within the limits of our present knowledge.

Activities of the Bureau

The activities of the Bureau may be grouped under four heads:

1. Work relating to fundamental measurements and the determination of constants.
2. Testing.
3. Compilation of specifications and codes of interest to industry and commerce.
4. Experimental research which forms the basis for progress in science, engineering, and industry.

With its equipment, personnel, and facilities, what is the Bureau doing of interest to industry? To answer this, even in summary form, takes some 300 pages in the forthcoming Annual Report. Here, we can but illustrate by reference to a few typical examples.

What the Bureau Does for Industry

Industry is interested in what the Bureau does for the other government departments since the government is the most extensive and varied business in the country, is the most important buyer, and engages in industrial and manufacturing operations of considerable magnitude. For activities covered by its field, the Bureau acts as scientific and engineering consultant, and as a research and testing laboratory; and many of the problems taken up at the instance of the government are directly applicable to industry.

Let us first consider specifications for the purchase of materials. The government is setting its own house in order by unifying specifications through the Federal Specifications Board, of which the Director of the Bureau of Standards is ex-officio chairman, and many members of the Bureau's staff serve on the 45 technical committees of the Board. The federal specifications are already in considerable demand in industry and undoubtedly will be found useful to many interested in production and purchasing. They are framed to meet both commercial manufacturing practice and government requirements, and will reduce confusion, complications, and waste in manufacturing, lower costs to the government, and serve as models to other purchasers. In the preparation of these government specifications, representatives of industry are consulted and the specifications are promulgated only after the Board is assured that they conform to current commercial manufacturing conditions.

The Dictionary of Specifications

Again, at the suggestion of Secretary Hoover, there is being compiled by the Bureau a Dictionary of Specifications, which it is expected will become a buyers' handbook, covering in the first instance, items of interest to federal, state, municipal, and institutional bodies. It is expected this will be also of great value to industry.

The testing work of the Bureau of Standards is voluminous and varied amounting to 117,000 items for the past year, about equally divided between demands of the government and the public, including, for example, some 30,355 thermometers; 1940 incandescent lamps representing 1,638,678 purchased by the government; 6700 weights; 39,000 cement samples; 3768 tests of radioactive materials; 3644 metallurgical items; and 832 railroad track and mine scales. The Bureau does not, in general, execute for the public, tests of a routine character, such as ordinary chemical analyses, when these can be done elsewhere.

Contacts with Industry

An allied service to industry is the preparation and distribution of standard samples of certified chemical analysis by which the accuracy of many chemical and metallurgical processes is controlled throughout the country, preventing litigation and other embarrassments. The Bureau was a pioneer and is the leader in this type of governmental service to industry. Our samples go all over the world.

Our contacts with industry are many in number and kind. The past year there were some hundred conferences with industrial groups in addition to representation by the Bureau on many committees of the engineering and technical societies. For several lines of work, there are regularly constituted advisory committees composed of representatives from industry who aid in outlining the experimental work done at the Bureau. The aim of the Bureau is to do those fundamental things of general interest to an industry, things that the industry wants us to do and which we can do most effectively and economically, such as the determination of physical and chemical constants and other experimental data which help define and reduce costs in manufacturing processes. It is well recognized that the brunt of the cost of industrial research should be borne by industry itself; nevertheless, there are many important problems of a fundamental nature common to industry which can be handled best by the active participation of a public research institution, such as the Bureau of Standards, and it is in the public interest that many such problems be developed by the participation in their solution of a government laboratory.

Bringing Producer and Consumer Together

Another very important phase of the Bureau's work in relation to industry is the bringing of producer and consumer or several industrial groups together in a common forum, and in the solution of problems usually involving experimental work, which no one group could solve to the satisfaction of the others. Almost every field of the Bureau's activity is concerned with one or more such problems of mutual interest to several branches of industry. As illustrations we may mention the joint committees on the effect of sulphur and phosphorus on steel; paper, textile, dye and hardware

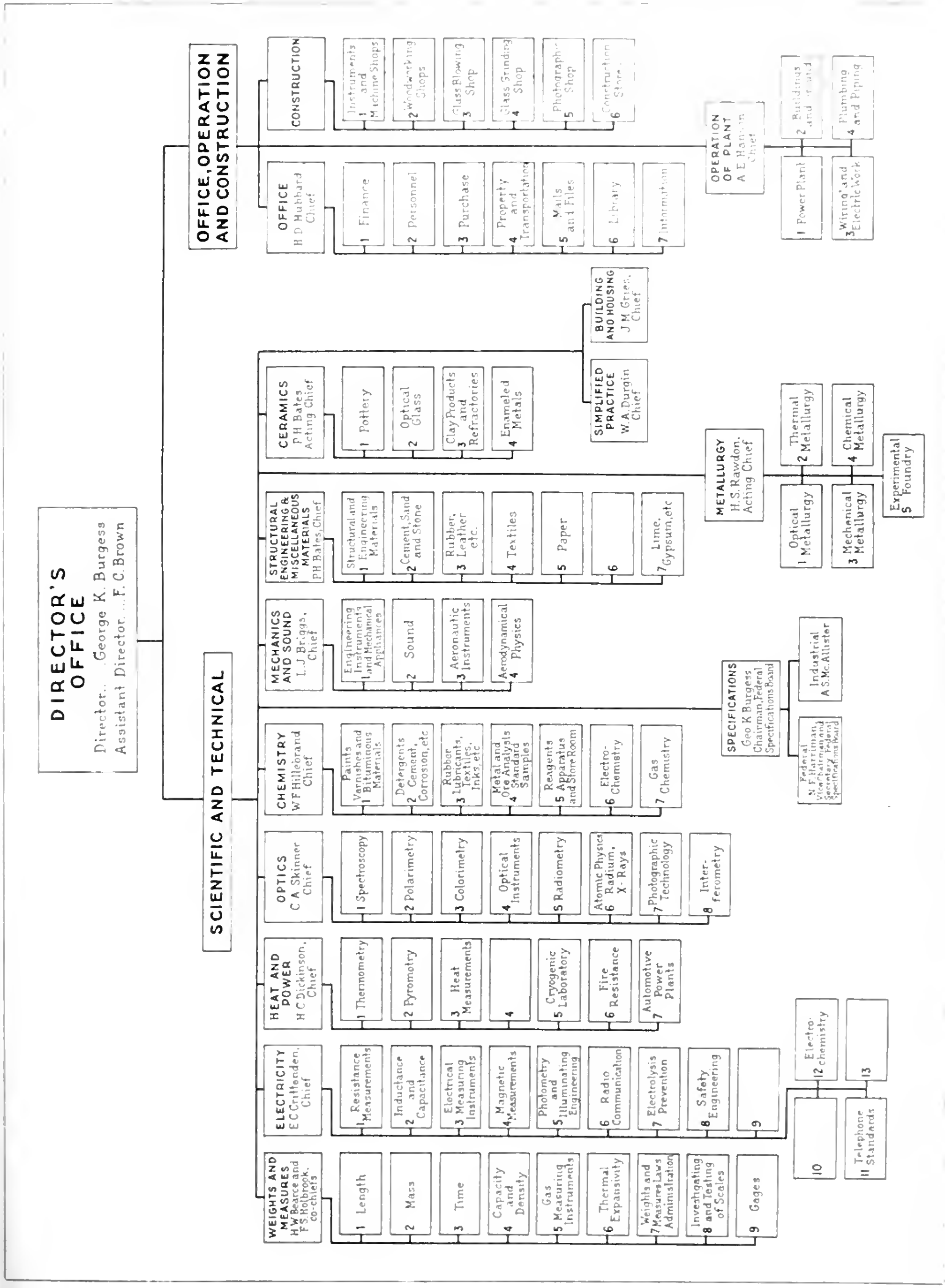


FIG. 1. CHART SHOWING THE DIVISIONS OF THE UNITED STATES BUREAU OF STANDARDS

standardization; welded rail joints and tanks; soil corrosion of metals; fire resisting properties of materials of construction; researches and testing methods relating to electro-plating processes, china and glassware, molding sands, brake linings, gasoline from natural gas, wire rope and many others.

The Bureau's Extensive Program

An instance in which the Bureau of Standards is the pioneer in developing a new industry is that of aeronautical instruments. The new navy dirigible ZR-1 is equipped with instruments designed and made here.

The Bureau has a very extensive program in aeronautical research including investigations of problems relating to engine design and fuel economy, navigation, weight reduction, and ballasting, factors influencing wind resistance, design and strength of aircraft parts. The Bureau is also sponsor under the procedure of the American Engineering Standards Committee for the Aeronautical Safety Code.

For the automotive industry, there is also an elaborate program under way including such items as engine testing, road performance of cars equipped with all manner of measuring devices, problems in ignition, carburetion, combustion, lubrication, radiation, and cooling, brake linings, efficiency of rear axles of trucks and efficiency of fuels.

An industry our British friends call a "key industry" is maintained at the Bureau, namely, the manufacture and improvement of optical glass. The Bureau has just completed the largest lens ever made from American glass. The Bureau made the glass and did all the work on the discs, 12 in. in diameter. As another instance of the determination of fundamental constants vital to an industry, we may cite the recent completion of the work on the properties of ammonia, of the greatest importance to the refrigerating industry. A similar investigation is under way relating to the properties of steam.

New Instruments Developed

Among the new instruments recently developed, in addition to the score or more for aeronautics, may be mentioned an electrical telemeter, and an optical strain gage, both of great use in strain and stress measurement for the structures dealt with in civil and mechanical engineering; as well as several instruments used in radio transmission, such as a new direction finder.

The Bureau has led in the introduction of pyrometric methods of control in metallurgical processes, and of spectral methods of analysis in the metallurgical and chemical industries; has produced the purest platinum yet made, and the nickel steel alloy known as "invar" of the lowest length change with temperature; has improved the quality, precision, and speed of production and lessened the cost of gage blocks which control the processes of precision mechanical construction; has initiated scientific research on dental amalgams; and improved many products and methods in the textile, ceramic, paper, electrical, sugar and other industries. The Bureau has several small manufacturing units including machines for making paper, textiles and rubber, as well as a rolling mill, and facilities for manufacturing pottery, lime, gypsum, concrete, refractories, alloys, and instruments. These plants permit varying factors at will, a condition often difficult to obtain under conditions of commercial production.

The facilities of the Bureau are used by industry itself for the study of some of its problems, advantage being taken of the system of research associates which has been established, by which a problem is attacked by a representative of industry stationed at the Bureau, usually by a trade association. Their work is published by the Bureau and thus made available to all interested. Incidentally these men are trained in research for industry.

Publication of Results of Investigations

The results of investigations conducted by the Bureau are published in pamphlet form. The papers are issued in five separate series:

1. Scientific Papers
2. Technologic Papers
3. Circulars
4. Handbooks
5. Miscellaneous Publications

An idea of the industrial value of these pamphlets may be obtained from the following list of a few of the hundreds of titles:

S 125. The Daylight Efficiency of Artificial Illuminants.
S 358. Concerning the Annealing and Characteristics of Glass.
S 387. Permeability of Rubber to Gases.
T 1. Effect of preliminary Heat Treatment upon the Drying of Clays.
T 19. Physical Tests of Cotton Yarns.
T 65. Determination of Oil and Resin in Varnish.
T 81. Liquid Measuring Pumps.
T 88. Studies on Paper Pulps.
T 96. Comparative Tests of Stitches and Seams.
T 120. Tests of Hollow Building Tile.
T 153. Area Measurement of Leather.
T 163. Stresses Caused by Cold-Rolling.
T 192. Tests of Centrifugally Cast Steel.
T 198. Results of Some Tests of Manila Rope.
C 20. Electrical Measuring Instruments.
C 41. Testing and Properties of Textile Materials.
C 77. The Table of Unit Displacement of Commodities.
C 112. Telephone Service.
H 3. National Electric Safety Code.

Space does not permit going into greater detail as to the Bureau's activities of interest to industry, and no reference has been made to the important work of the division of simplified practice, which is working in co-operation with industry to reduce types and sizes of many commodities; nor of the housing division which is working actively on many problems looking to economies in building construction. It is hoped, however, enough has been said to show the reader that the Bureau is using its opportunities and facilities wisely for the good of every branch of industry in the country.

Quantity Increase and Cost Decrease From Applied Standardization

IV—"The Organization of Modern Industry"

By DEXTER S. KIMBALL

Dean, College of Engineering, Cornell University

Class Number
658.16 Organization of Industry
658.516 Standardization

IT will be clear from the foregoing discussion that any plan or principle that tends to increase the quantity of any given product tends, also, to decrease its cost and hence is an important factor in production. Standardization is such an economic principle and deserves careful consideration. Standardization may be defined as the reduction of any line of products to fixed types and sizes. In many instances the number of types and sizes for which a commercial demand might be found is infinite.

For instance, there is no limit to the variety of styles in which shoes may be made, though custom and fashion usually limit this variety. Since, also, no

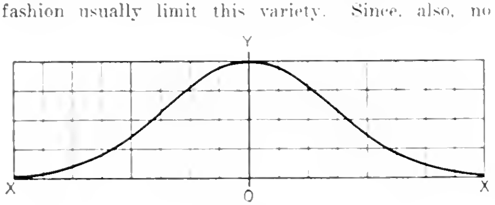


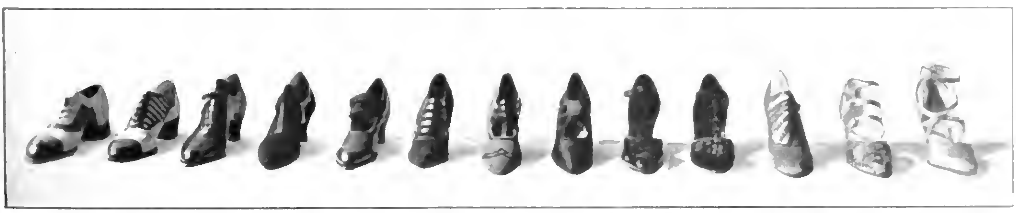
FIG. 25 A GENERAL PROBABILITY CURVE

two feet are exactly alike, it is possible to make a very great variety of sizes of any given type, each one of which would fit some foot. As a matter of fact, that is exactly what was done under handicraft methods where the shoemaker measured each foot and made a shoe to fit the peculiar dimensions of each customer. It will be clear, however, that for a given total number of shoes to be made the number of each type and size will be greater as these types and sizes are reduced in number. Experience has shown, furthermore, that in a large population there are many people whose feet are so nearly alike that one size of shoe will answer fairly well for all of them. The manufacturer, therefore, selects a few types of shoes that in his opinion will find favor in the market. He manufactures a limited number of sizes of each type, these sizes being selected on the basis of previous experience so that any man with feet of average size can find a shoe to fit him. People who have unusually large or unusually small feet must still have their shoes made to order, if they wish them to fit nicely.

The same general statements apply fully to the manufacture of clothing. As the population increases the number of sizes may be economically increased and more people can buy ready-made shoes or clothes that fit them well. Thus a few years ago collars were made in half sizes only, while now the quarter sizes are common and the increase in the number of sizes of ready-made clothing and shoes is well known.

In the field of engineering this principle has been very fully developed. Thus electric motors are made in a limited number of sizes though the commercial demand if met exactly would require an infinite number of sizes. And all are familiar with the standard size of nails, screws, shafting, piping, and automobile tires, electric lamp bulbs, telephones, sewing machines, hats and many other manufactured products of everyday use. Standard sizes are based upon average conditions and standardization may be called the method of the average solution. There are great economic gains still to be made by the use of this principle par-

* Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION, July 1923, p. 17; August 1923, p. 165; September 1923, p. 333.



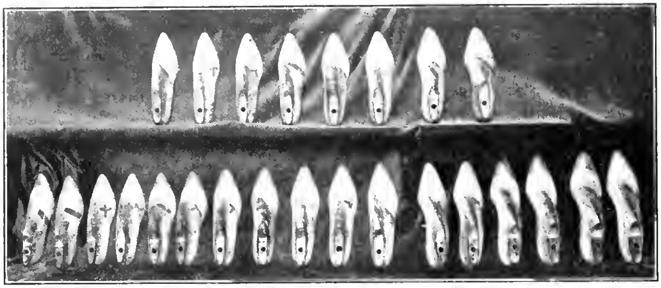
Courtesy of J. & T. Cousins Co.

FIG. 26 A GROUP OF 13 WOMEN'S LOW SHOES, ALL RIGHTS, SHOWING WIDELY DIFFERING LASTS AND STYLES

Beginning at the left the first two are sport models, the third is a morning shoe, then follow five afternoon shoes and the five at the extreme right are for evening wear.

ticularly in the building trades where windows, doors, and a great variety of building products are still made in an immense variety and no end of sizes. And this economic gain could be secured without loss of artistic appearance and with a decided gain in quality for reasons that will be shown later.

There is another and very important reason for standardization and that is the desirability of having parts *interchangeable*. Standards of exchange have long been in general use and these have been fixed most usually with a view to convenience rather than on a scientific basis. We have long been familiar with standards of exchange in weights, measures, currency, etc., and with interchangeability in a national way as illustrated by the standard gage of railways over which the cars of any railway company may pass. It is clear that standards and interchangeability viewed from this angle may be of national or even international importance.



Courtesy of J. & T. Cousins Co.

FIG. 27 LASTS SHOWING WIDTHS AND SIZES OF WOMEN'S SHOES

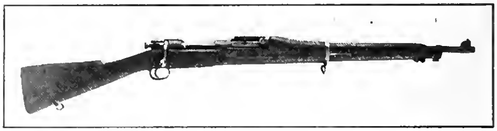
The 8 lasts in the upper row are all size 4. The widths running left to right AAAA-AAA-AA-A-B-C-D-E. The 17 lasts in the lower row are all width A, the sizes running from left to right, 2-2½-3-3½-4-4½-5-5½-6-6½-7-7½-8-8½-9-9½-10.

From the narrower view of productive economy interchangeability is desirable for three reasons. If the part in question must pass through a number of operations involving a series of machines it is essential that all parts shall be near enough to some standard in order that they will fit properly into the manufacturing tools that are used in its production. There is a still more important reason, namely, the great gain in time in assembling interchangeable parts as compared with those that vary in form and size and must as a consequence be fitted together with hand tools.

Furthermore, it is essential in many products today that repair parts be furnished that will fit accurately into place without any fitting by hand. In fact, many products such as guns, typewriters, automobiles, sewing machines, and many others cannot be successfully marketed unless there is assurance that they are built on the interchangeable system and that spare parts are obtainable that will go into place readily. It should be noted in this connection that the degree of accuracy attainable in interchangeable manufacturing depends upon the accuracy of the manufacturing equipment and upon the standards of measurements in use in the plant. In very fine work, such as rifle manufacturing, both of these requirements must be exceedingly refined.

The foregoing discussion has dealt with standards of form and size as basic considerations in productive economy. But modern standardization has a much broader significance. Thus, in well-ordered plants both the *quantity* and the *quality* of the material that is to go into each piece of product is carefully determined in advance. It is obvious that if the quantity of raw material necessary for a given piece of work is once determined it is poor economy to issue more than that amount. This holds, also, for supplies and expense material which are now budgeted in all progressive shops, each man being allowed the standard amount of such supplies that his duties demand. Equally important is the standardization of the quality of all materials, particularly in large-scale productions. This does not mean that the best of material should be used everywhere, but it does mean that when a certain material of a given quality has been selected as being best suited for a given purpose, this quality should be adhered to until further consideration dictates a change.

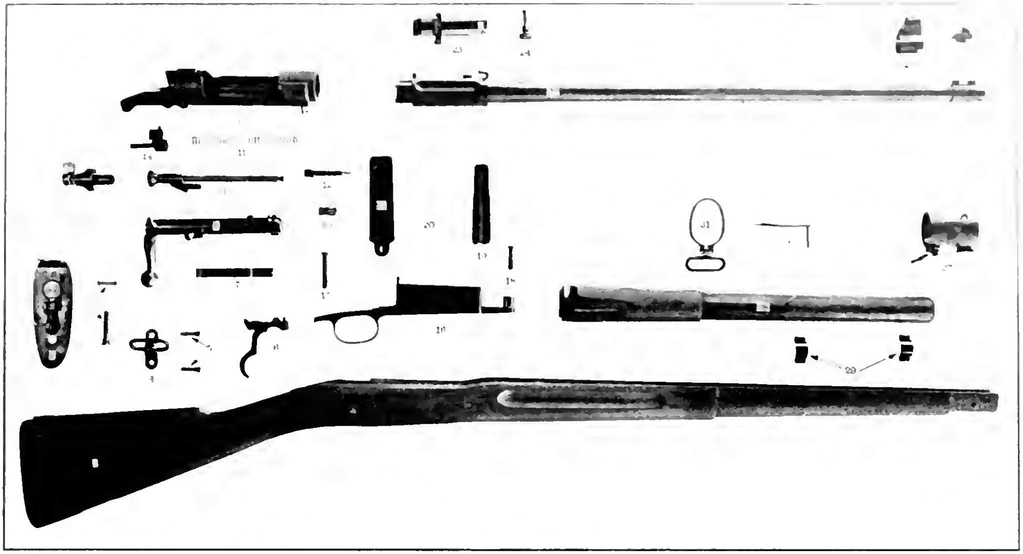
Furthermore, modern developments in industrial management have extended the application of standardization into the field of human endeavor. A casual investigation will show that most of us perform our wonted occupations in a very inefficient manner, both as to methods employed, and as to time consumed. The much debated application of motion study and time study aims to determine the best method and the shortest time in which a given operation can be performed so that this best method may be adopted as a standard procedure. There can be no doubt as to the economies to be made by thus standardizing human effort. The objections that have been raised against these studies and the application of results so obtained lies in the fear on the part of the workers that these methods may give the employer an advantage that he may use against them in an unfair manner. This matter will be referred to again in a succeeding article.



Courtesy United States Armory, Springfield, Mass.

FIG. 28 ASSEMBLED SPRINGFIELD RIFLE, CALIBER 30, MODEL 1903

The advantages of standardization in reducing productive costs will be obvious aside from its tendency to increase the quantity to be produced. Standardization by reducing the number of elements to be manufactured reduces the variety of necessary tools. The indirect expense also should decrease with standardization since less engineering talent and less clerical work and superintendence are required to handle a given output consisting of a few types and sizes than to handle the same product consisting of many types and sizes. The variety of stores that needs to be carried



Courtesy United States Armory, Springfield, Mass.

Fig. 29 Parts of Disassembled Springfield, Model 1903, Caliber 30

The parts are as follows: 1. Stock; 2. Butt plate; 3. Butt plate screws; 4. Butt swivel; 5. Butt swivel screws; 6. Sear and trigger, assembled; 7. Extractor; 8. Bolt; 9. Sleeve, assembled; 10. Firing pin, assembled; 11. Main spring; 12. Striker; 13. Firing pin sleeve; 14. Cut off, assembled; 15. Receiver; 16. Guard, assembled; 17. Guard screw, rear; 18. Guard screw, front; 19. Follower; 20. Magazine spring; 21. Magazine floor plate; 22. Barrel; 23. Rear sight, complete; 24. Rear sight windage screw; 25. Front sight cover; 26. Front sight, assembled; 27. Upper band, assembled; 28. Hand guard; 29. Hand guard clips; 30. Lower band spring; 31. Lower band, assembled.

can also be reduced, thus reducing the investment, and deliveries can be made more promptly with standardized goods than with those that must be built to special order. Standardization may also have a pronounced beneficial effect upon the quality of the product. Every machine or piece of finished product is in the first instance more or less of an experiment becoming increasingly so as the scientific and mechanical features become more complex. The more a given product is worked upon and the oftener it is built the more perfect it will be. Standardized product for these reasons, is likely to be more satisfactory than special product, everything else being equal.

There are, however, certain disadvantages connected with standardization that should be noted. One of the most important of these is its tendency to impede progress because of inflexibility. This defect can be seen in our system of weights and measures where the obvious advantages of the metric system are difficult of realization because of the many difficulties involved in making a change in a thing of this sort which has such universal use. In England an antiquated monetary system persists for the same reasons. Once a standard becomes widely used it is very difficult to change it, and for that reason the greatest care should be bestowed upon the selection of standards in the beginning of any enterprise. These disadvantages apply forcibly to the standardization of manufactured products. When drawings, patterns, and special machinery have been prepared for a standardized line of products they cannot, usually, be changed or adapted to other types of product, except at great financial loss, until they have paid for themselves in accordance with the principles discussed in the preceding article. Of course, such changes can be made when this has occurred, or when the tools and appliances are worn out. Occasionally, also, it may pay to discard such special appliances in favor of more advanced appliances, if it can be shown financially that the gain by using the new tools will more than offset any residual value the old ones may possess.

In the preceding article the law [1] of increasing productivity was stated as follows: The unit cost can, in general, be decreased as the quantity to be produced increases. It should not be inferred from the foregoing that this law holds indefinitely, nor that constant increase in quantity necessarily permits of constant decrease in cost. As there is a law of increasing productivity so there is a law of diminishing productivity which tends to limit it. This law is most readily explained in relation to land since the limitations of land in a productive way can be easily and sensibly appreciated. The application to manufacturing and other industrial problems is thus made easier of comprehension.

Suppose a farmer owns a plot of land that he is working with ordinary hand tools. It will be clear that if he hires a man to help him the two can cultivate the land much more intensively and secure a greater return in the way of products. It will be obvious, also, that he may hire a second man whose

[1] Management and Administration, September 1923, p. 333.

labors will still further intensify the cultivation and increase the yield. And a third or a fourth man may be employed advantageously. But, it is clear, also, that there will come a time when the cultivation will be so intense that the labor of an additional man will barely increase the yield sufficiently to pay his salary and beyond that point every additional man is employed at a loss even though his labors may increase the yield somewhat. Furthermore, there will come a time when the cultivation is so intense that no amount of labor will increase the yield. This example illustrates the law of diminishing productivity as applied to labor.

Again the farmer may decide to add to his capital equipment by improved drainage and by buying more and up-to-date machinery. In the beginning he may, and probably would, succeed in increasing the product of the soil. But, obviously, there is a limit to which he can go in this direction, also, as there will come a time when the gain will not offset the expenditure and finally there will also come a time when no amount of added capital will increase the yield. This illustrates the law of diminishing returns as applied to capital.

Or again the farmer may elect to buy a large area of land and indulge in large-scale farming in a manner

Courtesy of the Pratt & Whitney Co.

FIG. 30 PRECISION MEASURING ROOM IN WHICH THE TEMPERATURE AND HUMIDITY ARE CONTROLLED AND THE ENTRANCE OF DUST IS PREVENTED

The room is surrounded by double glass walls and has a suspended double ceiling. All heating and ventilating are through ducts. Entrance is through two doors with an air chamber between. The air is conditioned by a Carrier machine.

analogous to large-scale manufacturing. This would give him a greater opportunity to use division of labor, and since he now has large acreage he can advantageously purchase the latest improved machinery. No doubt, he can thus decrease the unit cost of production as compared to his smaller acreage, but here again the gain will be decreasingly less as he employs more men and more expensive machinery. For the law of diminishing productivity as applied to both labor and capital will finally assert itself and the time will surely come when additional men or additional machinery will not be justified by the resultant gain.

This principle which is so clear in the case of farming holds equally well for other industrial activities, though it is not always easy to recognize it. Consider, for instance, an office building with elevator service. For a given number of floors and a given quality of service a certain proportion of the floor space must be given up for the elevator shaft. If additional floors are added the amount of space allotted to the shaft must be enlarged for a given service, and the space available for rental proportionately reduced. Obviously, if the building could be made high enough the entire floor space would have to be devoted to elevator shafts if the service is maintained. Of course, as more floors are added the elevators may be speeded up, and the amount of shaft space needed can thus be somewhat reduced. This change would be equivalent to the installation of better machinery by the farmer. But here again there are limitations to the speed at which elevators can be operated and eventually the law of diminishing productivity again asserts itself and reduces the income per square foot of floor space as successive floors are added. It is assumed of course in this discussion that other factors remain constant. Thus a rise in real estate values might make the floor space in the building under consideration so much more valuable as to offset the effect of reduced floor space. But even granting that the value of real estate constantly increases the law would eventually assert itself because of the limits of elevator speed.

Similar limitations will be found to apply to the application of division of labor in manufacturing operations. Thus assume that a given piece of work involves several operations such as planing, milling, turning, drilling, etc. From the preceding discussion it will be clear that these operations can be economically separated as the quantity increases, each operation being assigned to one man or group of men to do nothing else. Thus a man may be assigned to do nothing except to drill a particular hole in each piece. Again, if the quantity is sufficiently large a drilling fixture or jig may be employed and the work of drilling may be subdivided by having one man put the parts to be drilled into the fixture and take them out again after the operation, another man doing the actual drilling and nothing else. But it would be difficult to subdivide either of these functions no matter how large the quantity may be, or if such a subdivision can be made it would not add to the output. Thus, in general, division of labor can be carried down to certain fundamental operations beyond which it is difficult, if not impossible to go, no matter what the quantity may be, and there is always a possibility that the point of greatest economy may be reached before subdivision into lowest fundamentals is reached.

It should be noted, furthermore, that division of labor must always be accompanied by some means of securing co-ordinated effort. If many men are working independently on many parts of the same machine, not only must all the operations be carefully planned in advance of this performance, but provision must be made to bring all of the parts finally into a co-ordinate whole. The general principles of mass management will form the basis of a succeeding article, but it should be noted here that as division of labor is extended co-ordinative measures must accompany such extension in the way of engineering and productive planning, clerical supervision, and careful inspection. All of these measures cost money and tend to offset the gain from division of labor. Failure to realize the fact that this cost may more than offset the gain has wrecked not a few beautifully devised theories of management.

The limitations to the use of transfer of skill are similar. As the quantity increases, machinery of greater and greater complexity and value involving transfer of skill may be employed, and in many instances this application can be carried to the point where the machinery is entirely automatic, requiring only the attention of those who can set and adjust the mechanisms. Aside from the limitations imposed by the quantity to be made, there are other economic limitations to the use of this principle that should be noted. In making shoes, for instance, a most remarkable set of machines has been devised for performing almost every detailed operation. Each machine, however, is of the semiautomatic type and requires the attention of an operator. No machine has been attempted, so far as the writer is aware, that will make an entire shoe automatically, and there is reason to believe that even if this were possible such a machine would be so complicated and expensive as to be incapable of competing with the semiautomatic machines now in use. Transfer of skill has been carried to a very high development in the production of individual parts, but there appears to be limitations to the extension of this principle no matter what the quantity may be. In other words the law of diminishing productivity appears also to govern the use of this economic principle. In the manufacture of such machines as typewriters many interesting applications of transfer of skill are employed in the production of the individual parts. But the final assembly and alignment of all parts is performed by hand and probably always will be. It might be possible to make a machine that would automatically assemble the parts, but its economic value is doubtful.

This discussion throws some light, also, on the reasons for the increase in the size of industrial plants, for it will appear from the foregoing that there are economic limitations to the use of division of labor and transfer of skill on which supposedly the growth and competitive power of most large undertakings are supposed to rest. There is reason to believe that many of our large industries have passed the point where any great gain in productive efficiency can be had through further division of labor and the use of labor-saving machinery. This opinion is borne out by the fact that many manufacturing plants of moderate size have existed and competed successfully against very large plants, in many cases being able to undersell their larger competitor and without the protection of patents or trade secrets. In all probability a large factor in the success of these smaller plants is the lower overhead expense as compared to their larger competitors. This reduced expense has been brought about, in many instances, by specialization of greater

Courtesy Pratt & Whitney Co.

FIG. 31 ROOM IN WHICH HOKE GAGES AND SIMILAR WORK ARE LAPPED

Here the temperature is held within 3 or 4 deg., the air is washed to free it from dust, and the flow of air is always from the room outward as excessive air is admitted.

or less degree, the amount of technical, clerical, and manufacturing supervision being thus reduced to a minimum. At the same time these smaller plants have manufactured in sufficiently large quantities to secure the full benefits of division of labor and transfer of skill that is permissible in the particular product they manufacture.

Every manufacturer must base his hopes of success on one of three general factors, namely, price, quality, or monopoly. The foregoing discussion applies largely to competition on the basis of price. It will be clear that in such competition no economic principle and no shop practice that will reduce productive costs can be neglected. The market price of goods produced for an open competitive market is usually close to the margin of profit and in many instances below the margin of profit for any but the keenest industrial managers. In fact poor management, and particularly poor cost finding methods, are largely to blame for this condition that is chronic in some fields judging by the industrial failures. To all manufacturers producing for such open markets these economic relations are of utmost importance.

There are a limited number of manufacturers who produce and sell on the basis of quality. Such manufacturers aim to supply a product so good that all who are able will buy it in preference to cheaper competitive goods. No doubt there is often a great advertising value in asking a good price for a good article, and avoiding the appearance of competition with an inferior brand. But even here a knowledge of the most refined methods and of the relations that have

INSTRUCTION CARD FOR METHOD OF OPERATION Female Labor
Corona Typewriter Company, Inc.

Date Issued 11/28/21 — 3 — Part No. 375
Operation No. 5 — Drill, burr and tap four holes.
Time allowed at 100% efficiency for 100 pieces 1.52 Hours — Rate paid for 100 pieces $.48
Output required at 100% efficiency 65 pieces per hour — Earnings at 100% efficiency $.312
Time allowed on route board for 1,000 pieces 19.00 H.

DETAIL OF METHOD OF OPERATION — 100% TIME ALLOWED

Operator works sitting down.

		100% Time Allowed
1-	Take one piece from pan of unfinished work, on table at left of operator, and locate in fixture. Clamp top of fixture to hold piece securely. (Three clamps)	.06
2-	Place fixture under drill and drill four boles with #44 drill.	.25
3-	Turn fixture over, move to next spindle and burr four drilled boles with #22 drill. Turn fixture over, unclamp two end clamps and throw back top of fixture. Place under same spindle and burr opposite side of four drilled holes.	.28
4-	Move fixture to next spindle and tap four holes with 3-48 tap.	.17
5-	Unclamp and open remaining part of fixture top. Remove piece and place in pan on table at right of operator.	.04
6-	Clean fixture with air.	.03
	Rest allowance at 5%	.0415
	Machine, tool delay and gauging allowance at 5%	.0415
	Total time allowed for 1 piece	.913 min.

Inspection Instructions Walking Inspector:
Gauge size of drilled holes. G. ST-234.
See that holes are correct distance from end.
See that holes are aligned up.
Gauge size of tapped holes. G. ST-219
See that holes are not stripped and are tapped straight.
See that holes are properly burred.

If Operation or instructions can not be performed as outlined or changes are required, notify the methods Division of the Planning Department immediately.

Method Approved C.H.Bradt Date 11/26/21.
Rate and instructions approved C.S.Perry Date 11/26/21.

MACHINE AND SET UP INSTRUCTIONS

Machines (on which job can be run on piece work) 040305-06.
Emergency machines (on which job can be run but not on piece work) None
Location of finished work In pan on table at right of operator.
Location of unfinished work In pan on table at left of oparator.
Condition in which work will come to job As completed on previoue operations.
Material Kind Needle bar — Thickness — Dia. .193" — Grade
Number of machines run by operator One — Lubricant used Compound — How used Pump- medium flow
Spindle Speed 1524 R.P.M. for drills
2138 for taps.
Tools located in tool Crib No. #10.

All Tools, Equipment and gauges required (Give all Tool numbers)

Chair for operator.
1-Fixture # 522
2-Tables
Supply of #44 drills
" " #22 "
" " 3-48 taps.

Gauge ST- 234
" ST- 219
Pans for finished work
Chuck wrenches
Compressed air connections

INSTRUCTIONS FOR SET UP OF JOB — 100% TIME ALLOWED

Method of set up not standardized.

Supervisor or set up man will see that all tools, gauges etc., are at the machine; that speeds are correct; that work is at the machine; that the required standard of quality is obtained, before assigning an operator to this job.

TOTAL TIME ALLOWED

Courtesy of Corona Typewriter Company, Inc.

FIG. 32 AN INSTRUCTION CARD WITH COMPLETE TYPEWRITTEN DATA

been discussed is important since, obviously, if the maker of a superior article can, by advanced methods, produce his wares for little more than his competitors who produce an inferior article his advantage in the market is greatly enhanced.

If a manufacturer possesses basic patents or has control of natural resources he can in a way set his own market prices, so long as he produces a commodity that is desirable and so long as his prices are not so high as to cause purchasers to buy a substitute. To such a producer refined methods of manufacturing and selling may be of less importance since he is protected from serious competition. Basic patents cannot be easily obtained, but monopolistic protection can often be secured by integration and consolidation and undoubtedly this idea lies back of most of such movements. Another method of securing protection against ruinous competition is for the manufacturer to acquire stock in organizations using his product, thus securing a friendly co-operation or even controlling the placing of contracts for new supplies or apparatus.

It will appear, therefore, that the reasons for the growth of industries and the influences that tend to limit that growth are far from simple. If a true analysis could be had of the growth of these large industrial plants and integrated industries, all of these influences would be found to have had a part in accelerating or retarding this growth. It seems fairly certain that some of these great industries could not have been built up under a strictly competitive system, though there are a few very large plants where this appears to have been the case. It is an interesting question also how large these industrial enterprises may become before the limiting factors that have been discussed operate to diminish their productivity so that their productive and competitive advantages will cease to exist. It should be remembered in this connection that state and federal regulations may also affect this phase of industrial life.

The general changes in the industrial and social status of the worker because of this extension of division of labor and transfer of skill have already been noted. Large-scale production naturally affords an opportunity to push these economic principles to an extreme. In some callings, as in the shoe industry, these specializing influences have totally disintegrated the old handicraft calling and have substituted in its place groups of specialized men of many grades varying from the manager or designer whose work is purely mental down to the operative of whom little skill and almost no mental effort is required. Specialization of itself is not so deplorable as many assert. Thus we approve fully of the physician who specializes on one ailment or the teacher who specializes on only one branch of learning. But in many of the specialized industrial operations the mental and manual skill required has been so reduced and the operations must be repeated so rapidly and with such concentrated attention as to constitute a menace to the body and mind of the worker. Repetitive operations of themselves may not be deadening to the workers' mentality, as illustrated by cigar making, where the monotony of the work is often varied by professional readers. As has been shown it is probably not possible economically

Courtesy of Schwab Bros. and Baer

FIG. 33 A CIGAR FACTORY READER

About 250 Cuban cigar makers are employed who speak little English. The reader reads in Spanish for about 1 hr. per day. In the morning he reads from a daily newspaper and perhaps a magazine. In the afternoon he reads from some book which has been selected by majority vote.

to carry many of these repetitive processes from the stage of semiautomatic machinery to that of the full automatic, and no doubt there will be a constant increase in the number of workers in these trying repetitive operations as industries increase in size. Enlightened management must see to it that such limitations are placed upon the hours of labor in such industries, that with proper means of relaxation from the strain of concentrated repetition both the physical and mental health of the worker will be assured.

Another most important effect of these specializing influences is their tendency to classify men. In large-scale production this may bring together large bodies of men working upon some small detail of the product. In such a group the personality of the individual worker becomes submerged in that of the group and he becomes to the manager simply one out of many, all rated alike, unknown to him, perhaps, by face or name, a numbered cog in the great human machinery of the enterprise. In such cases, recognition of any superior qualities as a man or as a worker that any individual may possess becomes increasingly difficult, the tendency in such organizations being to standardize men into classes and to fix their wages and other conditions of service accordingly. What could be more natural than that under such conditions men turn to class organization as a means of self-protection, and as a means of keeping their wage as high as possible.

(To be continued in the November issue.)

Economy Formulas for Labor-Saving Equipment

Class Number
658.28 Labor Saving Equipment
657.524:658 Cost Control

THE Materials Handling Division of the American Society of Mechanical Engineers has recently received the report of its committee[1] appointed to consider and develop formulas for computing the economies of labor-saving equipment. The following outline of this report explains the basis upon which the investigation was made and the resulting mathematical expressions derived.

The whole problem is considered to be one of comparative costs. In the past it has been customary to charge items of overhead burden against installations of labor-saving devices. These items properly include superintendence, employees' liability, welfare activities, maintenance of buildings and machinery, fuel, supplies, insurance, depreciation, taxes and similar expenses. Rarely, however, does it appear that the installation has been correctly credited with any contingent addition in computing the financial value of labor saved by the new methods.

The formulas which the committee have developed aim to give mathematical expressions of the debit and credit items of the new installation as compared with the old method. In devising such expressions due consideration and weight was given to the fact that overhead burden, including "indirect labor" is usually from one-half to three times as great as the direct labor involved in a process.

Hence, the problem took on largely an economic phase. That is, to each expenditure for improved devices there should be added not only; (1) a fixed

[1] Personnel of the committee: W. F. Hunt, J. A. Shepard and C. H. Newman.

charge expressed as a percentage of capital invested, but also (2) an amount, in percentage, representing the value of labor saved as its proportion of "burden" saved. Burden items usually bear a fairly proportional relation to actual labor involved in the work.

When calculating the cost of the finished product, if an improved process or equipment affects the amount and hence the cost of the "direct labor," then, for the most accurate results, the burden should be applied to labor *saved* at the same rate as labor *used*.

In calculating the cost of product, non-productive labor is classed as one part of burden. As such, it should not itself bear any superimposed charge from the other items of burden. But where comparative economies are the basis for the accounting, then non-productive labor should be charged with all the elements of burden except the one it forms of itself.

Every new process must be compared with the one it replaces in determining relative economy. Units of labor in one will offset equal units of labor in the other and no burden need be considered up to this point. But the *difference* in labor must be subject to its proper addition for burden, and this burden should be applied on both productive and non-productive labor in correct relative proportion.

The two common mistakes in current practice have been:

1. The omission of burden charges on that portion of labor *saved* in comparing costs.
2. The omission of burden charges on indirect labor in comparing costs, although they were added to direct labor.

The following rule has been evolved for setting a value upon labor saved:

Whatever valuation is arrived at in cost accounting as the cost per unit of labor *used* in production, also establishes the value per unit of labor *saved* by an improved process. For simplicity, no monetary value need be placed upon labor employed in comparative processes, except upon the amount of *difference* in labor required at the current rate paid, plus "burden" or an equivalent.

Other items of cost must be accounted in the same manner as is done in calculating the cost of a product.

A second element introduced in comparative accounting, although not in regular cost accounting, is the monetary value of increased production. Improved methods or devices will reduce the cost of making an article (because more are produced in a given time) just the same as a reduction in one or more of the items of directly applicable cost. The rule proposed is, that:

In a comparative accounting increased production will always carry a higher value than that attached to normal production.

With the above development as a foundation the committee has submitted the formulas for calculating economies of labor-saving equipment given herewith:

Let:

Debit Items:
- A = percentage allowance on investment.
- B = percentage allowance to provide for insurance, taxes, etc.
- C = percentage allowance to provide for upkeep.
- D = percentage allowance to provide for depreciation and obsolescence.
- E = yearly cost of power, supplies, and other items which are consumed, total in dollars.

Credit Items:
- S = yearly saving in direct cost of labor, in dollars.
- T = yearly saving in fixed charges, operating charges, or burden, in dollars.
- U = yearly saving or earning through increased production, in dollars.

X = percentage of year during which equipment will be employed.
I = initial cost of mechanical equipment.

Results:
- Z = maximum investment in dollars justified by the above consideration.
- Y = yearly cost to maintain mechanical equipment ready for operation.
- V = yearly profit from operation of mechanical equipment.

Then:

1. $Z=\dfrac{(S+T+U-E)X}{A+B+C+D}$
2. $Y=I(A+B+C+D)$
3. $V=[(S+T+U-E)X]-Y$

Application of the Formulas

As an example, the report presents typical figures:

One man operating an electric storage-battery truck takes the place of four men in handling miscellaneous materials.

Let:

$3.50 = the rate per day per man in each case.
3.00 = basic number of days per year.
2.40 = actual number of days operating per year.
10 = percentage of fixed charges borne by this "non-productive" labor.
A = 6 per cent allowed on investment.
B = 4 per cent allowed for insurance, etc.
C = 20 per cent allowed for upkeep.
D = 25 per cent allowed for depreciation.
E = $450 for power and supplies annually.
I = $2200 cost of truck.
U = $650 value of increased production.

Then:

$S = (4-1) \times \$3.50 \times 300 = \$3150$
$I = 0.10 \times \$3150 = \$315$
$X = \frac{240}{300} = 0.80$ or 80 per cent
$Z=\dfrac{(\$3150+\$315+\$650-\$450)\times 80}{(6+4+20+25)}=\$5331$
$Y=\$2200\times(6+4+20+25)=\$1210$
$V=[(\$3150+\$315+\$650-\$450)\times 0.80]-\$1210=\$1722$

Or, Z, the maximum investment justifiable, is $5331, well above the cost of the truck, $2200.

Y, the yearly cost of operation is $1210.

V, the yearly profit, is $1722, or 78 per cent return on the investment of $2200.

A Daily Balanced Pay-roll System

In Use for the Past Two Years in the Plants of the American Rolling Mill Company

By LEWIS J. BROWN

Member of the Firm of G. Charter Ha[illegible] Associates

PROBABLY one of the best evidences of the progressiveness of the American Rolling Mill Company is the fact that for several years it has been operating on the basis of 8-hr. turns and that it is also rapidly changing over a large unit recently purchased to this basis.

One of this company's slogans is "Happy Men on Happy Jobs." There is no evidence of paternalism in the company's attitude towards its employees, which is based on a firm belief that the prosperity of the company depends upon the material and moral welfare of the members of its working force. Labor troubles are practically unknown in this organization.

The American Rolling Mill Company believes in sharing its prosperity with those who help to make it; its profits are shared with salaried employees through the medium of a carefully worked-out special compensation plan. In the case of hourly workers who can hardly be expected to see a very direct connection between their individual efforts today and a distribution of the annual profits, far-reaching bonus plans have been introduced which give the employee a direct monetary interest in the realization of a high degree of efficiency.

Need of Efficiency Information

The rapid growth of the business and of the working force, added to the increasing demands of the mill superintendents for prompt and reliable information as to the efficiency of the labor force, rendered it necessary for the American Rolling Mill Company to give careful attention to devising methods of pay-roll accounting which would meet these increasing demands without requiring undue expenditures. The plans described in this article, while greatly extending the range of information and also enabling the pay-roll and its distribution to be completed very much more promptly than formerly, have at the same time rendered it possible to reduce the clerical force engaged in this work.

The plan has been in successful operation for two years. The results achieved are due to careful design, whole-hearted co-operation on the part of the operating and pay-roll organizations, and to the use of mechanical equipment, particularly that of the tabulating and sorting machines of the Tabulating Machine Company, without which it is to be questioned whether the results obtained could have been realized without greatly increasing the clerical expense. The Kardex visible record equipment has also been of material assistance in the operation of the plan.

Class Number
658.41 Employment Records
658.31234 Pay-roll Systems

The pay-roll system of the American Rolling Mill Company has not been restricted to the mere compilation of accurate pay-rolls but has been designed to furnish daily information for the assistance of the operating management in its control of the labor force; to provide correct distributions of the pay-roll; and to give a wide range of pay-roll statistical data covering records of attendance of individuals, groups, departments, and the plant as a whole, daily reports of variations from the standard force and other statistical data of value to the operating management.

Briefly summarized, the objects which have been obtained by this pay-roll system are as follows:

1. It provides a daily balanced pay-roll and pay-roll distribution and renders it possible for a worker leaving the employ of the company to be paid off immediately.
2. The complete pay-roll is ready for payment a few days after the close of the pay-roll period, and the labor distribution, which is very extensive, is delivered to the cost department two days after the close of the month, enabling the cost sheets to be completed as early as the fifth of the month.
3. The daily balancing of the pay-roll and pay-roll distribution equalizes the work over the entire pay-roll period, thus eliminating the necessity for high pressure on the pay-roll department at the close of the pay-roll period and at the end of the month.
4. It provides the superintendents with daily reports of the efficiency of the working force.
5. It provides the employee with complete information as to the method of figuring his pay and of determining his bonus earnings.
6. It provides complete records for each employee for income tax purposes.
7. It provides complete attendance records.
8. Due to the numerous automatic checks on the pay-roll provided by the plan, disputes as to pay are practically unknown.

The plan is designed for paying off employees each week, the pay period ending on Saturday night and pay days coming on the following Wednesday, Thursday, and Friday. This method has many advantages—it eliminates the necessity of making cash advances between pay days, it distributes the work of the paymaster in the larger plants over a period of three days, and it ties up with the weekly operating cycle, thereby allowing a comparison to be made between the cost of labor and production.

It may be thought that a pay-roll system to give this information must necessarily be elaborate and expensive, but by careful planning and by the use of proper mechanical equipment, it has been possible to obtain many classes of information with little, if any, additional work over that required to furnish one class of information solely, and generally speaking, this fact appears to have been overlooked in many organizations where efforts primarily have been directed merely towards obtaining correct pay-rolls.

Employment and Clock House Records—Fig. 1

Placing the right man on the right job is the function of the employment department and is an important factor in the increase of labor efficiency. A close study of the prospective employee at the time of selection is well worth while as considerable expense can be eliminated by the decrease in labor turnover resulting from the elimination at the outset of undesirable applicants.

To insure that no one be employed except by the centralized employment department, instructions are issued to the pay-roll department not to write names of new employees on the pay-roll before receiving instructions from the employment department. This does not mean that the department superintendent or foreman does not have anything to say regarding what men should work in his department, as the prospective employee must be satisfactory to him before being actually hired, but it is the function of the centralized employment department to obtain complete information pertaining to the applicant and to weed out the obviously unfitted applicant before submitting applicants for the consideration of the foreman or superintendent. This also is true as regards interdepartmental transfers and changes in rates or jobs which all pass through the employment department.

When a prospective employee has been interviewed by the interviewer in the employment department and it is found that his qualifications are in accordance with the requirements as shown on the Job Specification Card, a complete record as to his personal qualities is written on the Employment Record (Form A). At the same writing two additional copies are made by the use of carbon paper of the information appearing on Form B which is a duplicate of that shown on the upper left-hand section of Form A. This is illustrated by line 1 on the diagram.

The two copies of Form B, which are then known as Employment Certificates, are handed to the employee together with Form M (see Fig. 3), which serves as his individual pay-roll record for the current period, and also as the authority to the pay-roll department to add his name to the roll. The applicant is then sent to the pay-roll department where he presents all of the forms just mentioned to the pay-roll clerk who proceeds to assign him a clock number by referring to the clock number record (Form C). This record is a numerical index of all clock numbers assigned to the employees in each department, showing serial number, name, date started, transferred, and date quit. The serial number indicates the department sections to which the employee is attached, the first digit representing the main department section as, for instance:

0 Miscellaneous Operating.
1 Blast Furnace.
2 Steel Plant General.
3 Blooming Mill.
4 Open Hearth.

The second digit indicates the department section, the third and fourth representing the serial number of the individual, John Smith's number 4170 indicating that John Smith is working in the melting section of the open hearth department.

After the clock number has been assigned, it is posted to both copies of the Employment Certificates (Form B) as illustrated by line 2, and also on the Individual pay-roll (Form M). A clock card (Form E) is then issued, showing the employee's number and name, which is handed to the employee together with a Schedule of Pay Days (Form D), Temporary Badge (Form F), and the two copies of the Employment Certificate (Form B). He is then instructed to go to the clock house at the entrance of the plant, or, if it is necessary to have department clock houses on account of the main departments being so widely scattered, he is sent to the department clock house. The pay-roll clerk takes the pay-roll (Form M) and places it in the proper order in the visible file ready for posting the daily earnings as illustrated on Fig. 3. He also notifies the Addressograph clerk to make a plate for the new employee; all future clock cards, pay-rolls, pay checks, etc., being made up from this plate.

When the employee arrives at the clock house he hands his clock card to the clock house clerk who instructs him as to the method of punching the time clock and as to where to call for his pay check on the regular pay day. He is also instructed to change his temporary badge, at the end of three days, for a permanent brass badge. A guide then takes the employee to the foreman of the department where he is to work, to whom he hands the two copies of the Employment Certificate (Form B), on which the foreman records the date and time the employee started to work. Should the foreman put the man to work on a job different from that shown on the employment certificate, he changes the certificate to show the correct name of the job. The foreman or department superintendent then approves both copies of the employment certificate and sends one copy to the employment department and retains the other copy for his own records. The employment department uses its copy for completing the Employee's Record Card (Form A).

The Foreman's Daily Force Report—Fig. 2—Form G

On the Foreman's Force Report (Form G) he reports daily the clock numbers of all employees working in his department. On the front side of this report is printed the standard force required to operate the department for turning out a certain production. It

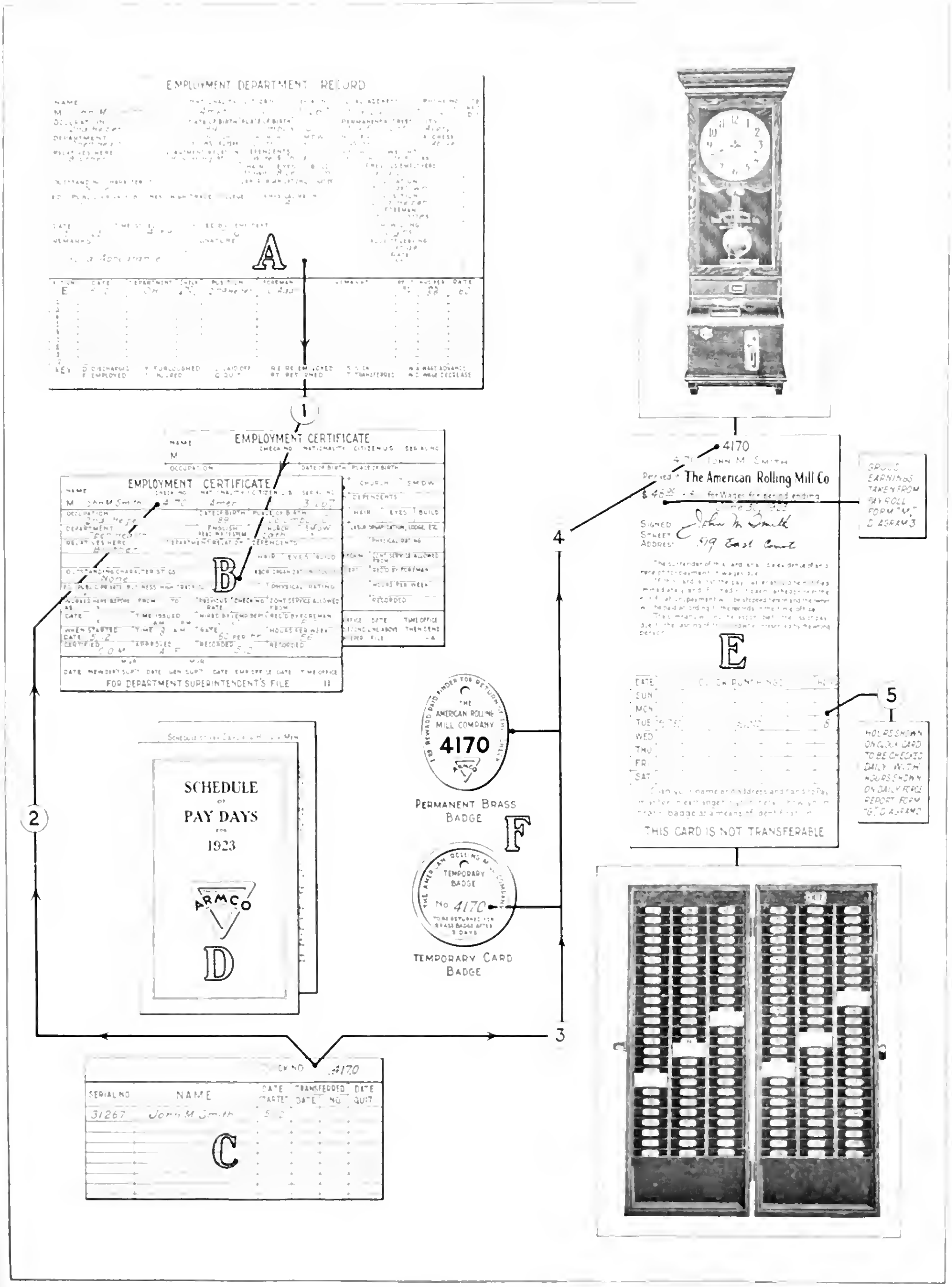


FIG. 1 EMPLOYMENT AND CLOCK HOUSE RECORDS

also furnishes information necessary for the compilation of the pay-rolls and their distribution to the card of accounts. On the back of the force report are printed the department organization outline in graphic form and complete instructions relative to the figuring of bonuses for the occupations as shown on the front side. From the above it will be seen that this form serves four purposes as follows:

A record of standard force.
A record of job rates.
A chart record of organization.
A record of bonuses and explanations.

This record, besides forming the basis of the pay-roll, has proved to be of great assistance in controlling the number of employees in each department by restraining the tendency of superintendents and foremen to make requests for additional help as soon as they are pushed for production and before such additions are really necessary. Immediately the Foreman's Daily Force Report indicates that the number of employees is in excess of the standard for the current production, this fact is called to the attention of the general superintendent by the chief clerk on the Variations from Standard Force Report (Form H) as illustrated by line 4. Steps are then taken to release or transfer the excess employees. This check on the force renders it possible promptly to correct the inefficient condition instead of allowing it to run along until the end of the month and result in a poor showing on the department cost sheet.

To eliminate unnecessary writing on these daily force reports, information that is more or less permanent is printed. An illustration of this is the example shown on the diagram which represents the Foreman's Force Report for the open hearth department, the printed information on this form embracing the following:

Name of the department and the section, this being shown at the top.
Code for mailing list.
Final charge, this being the account to which labor is charged.
Standard number of men.
Turns in 24 hours.
Standard hours per turn.
Standard days per week.
Name of occupation.
Furnace number.
Bonus reference.
Authorized rate per hour.
Earnings per day.

At the end of each turn the turn foreman enters on the Foreman's Force Report the clock numbers and the hours worked of all the men under his supervision, these numbers and hours being placed opposite the respective names of the jobs on which the men are working so that each will receive the job rate paid for the particular job. The turn foreman then signs his name at the bottom of the form and leaves the report for the turn foreman of the next turn likewise to fill in the numbers and hours worked for the men under his supervision. The report is made in triplicate, carbon paper being used for this purpose. The first two copies, after the end of each day, are sent to the clock house clerk who checks the hours as there shown with those printed on the Clock Card (Form E). This operation provides an excellent check on the correctness of employee's time, any variations between the time as shown on the Foreman's Force Report and as printed on the Clock Card being referred back to the foreman for an explanation of the reason for the difference.

The clock house clerk then forwards the first copy of the Foreman's Force Report to the pay-roll department, and the second copy to the chief clerk who, as before stated, compiles a record of variations from the standard force on Form H as illustrated by line 4.

When the force reports are received in the pay-roll department, they are handed to a Comptometer operator who totals the actual hours worked for each charge account number, entering the same in the "Total for Job—Hours Worked" column on the right of the form. These total hours are then extended at the job rate and the amount entered in the "Total for Job—Amount" column. The total hours and the amount for each charge are used for distribution purposes, as explained later, and illustrated by lines 7 and 8.

Labor Assignment Card—Form I

Quite often it is necessary for men to be loaned by one department to another, and when this happens, unless a proper check is provided, there is a danger that the employee's time will not be reported correctly and men will be transferred from one department to another without the knowledge of the employment or pay-roll department.

The Labor Assignment Card (Form I) is provided for reporting labor assigned temporarily to other departments. This form is designed to be used in connection with the Hollerith tabulating and sorting machines and is made in three copies, the first and second copies being carbon-back sheets and the third copy a Hollerith card placed in a folder made by the first and second copies. The printed matter is arranged so that when the first and second copies are folded the written information will match up on all three copies.

This Labor Assignment Card is made up by the foreman loaning the employee and gives the following information:

The name of the loaning department.
Date issued.
Clock number of employee loaned.
Name of foreman sent to.
Department sent to.
Time man sent (this information to prevent employee wasting time en route).

The three copies of the card are then placed in a metallic holder and given to the employee who is instructed to present the card to the foreman of the department shown thereon. The employee is then put

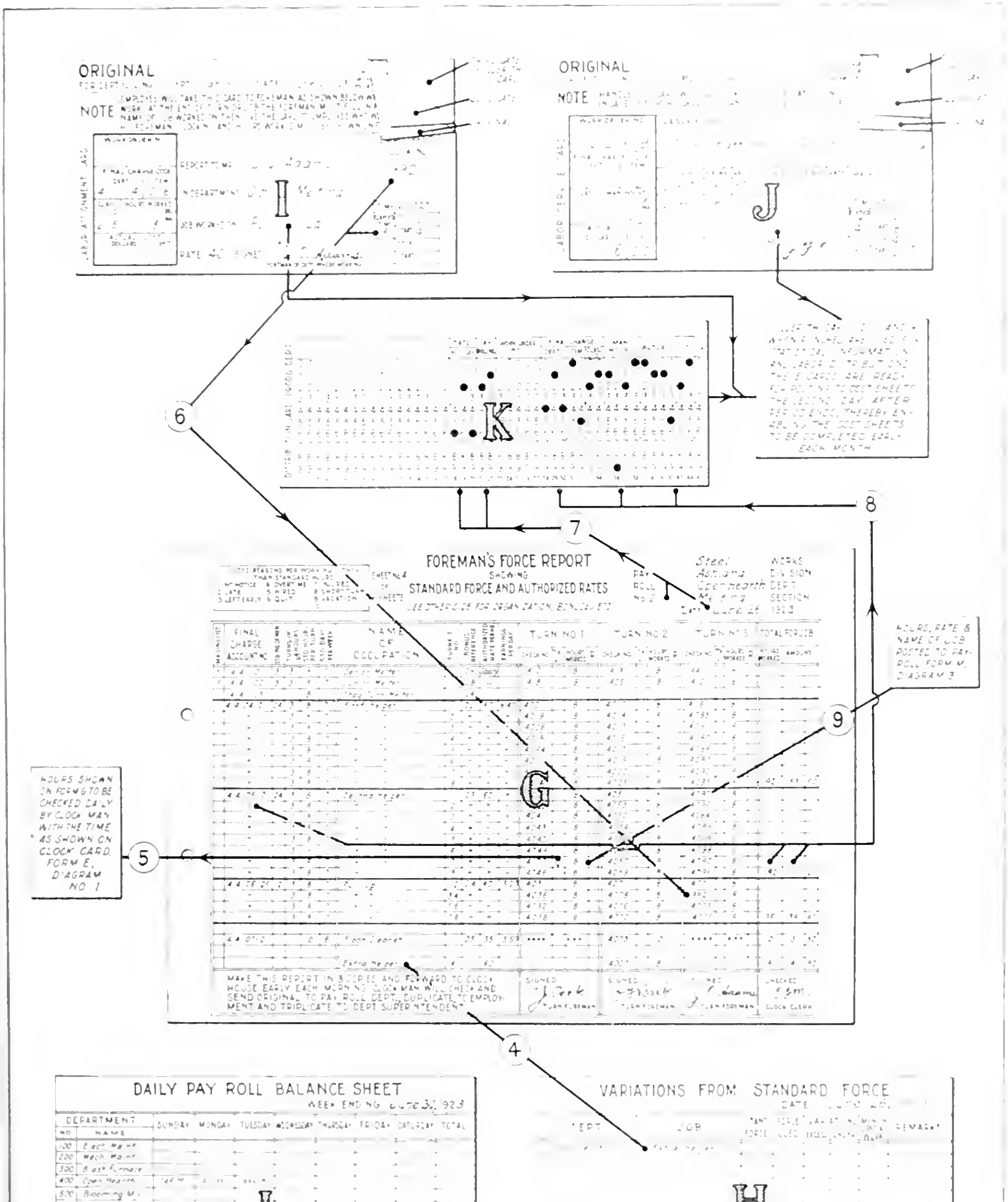


FIG. 2 REPORTS FORMING THE BASIS OF PAY-ROLL AND PAY-ROLL DISTRIBUTION

to work, the foreman keeping the card until the end of the turn or until the employee leaves his department, at which time the foreman enters the following additional information on the card:

Name of job worked on.
Work order number (this is if the work was on a special order).
Final charge code.
Hours worked.
Job rate.

The employee's clock number is then recorded on the Foreman's Daily Force Report (Form G) opposite the job he was working on, illustrated by line 6, and at this time the final charge code and the job rate are posted to the Labor Assignment Card. The three copies of this card are then given to the employee who returns it to his own foreman, who enters the employee's clock number and the hours worked on his Foreman's Force Report (Form G) noting in the column "Name of Occupation" the word "Loaned" and the name of the department loaned to. As the plan provides for the employee's number and the hours worked to be shown on both the Foreman's Force Report of the department loaning the man and on the same report of the department where working, it is obvious that if both these reports correspond there is no danger of an employee being left off the pay-roll or given credit twice for the same time.

The Labor Assignment Cards are forwarded with the Foreman's Force Reports to the pay-roll department each day, where they are used for distribution purposes. The first copy of the Assignment Card, after being extended and checked, is returned to the foreman loaning the employee; the second copy is sent to the department superintendent or foreman charged with the labor; and the third copy on a Hollerith card is used for cost purposes.

The Labor Service or Time Distribution Card (Form J) is arranged for the Hollerith tabulating and sorting equipment, and in design is similar to the Labor Assignment Card.

This card is used in the maintenance and labor departments for reporting the time spent on each job, in which departments it is not possible to print any regular charge account number on the Foreman's Force Report as a man may work on several jobs during the day and in different departments.

The Labor Service Cards are also used in the shops or maintenance departments for scheduling work, the following information being written up by the shop clerk at the time the work order is issued:

Name of department.
Work order number.
Description of job.
Date required.
Pieces on order.
Machine or equipment number.

The cards are then placed in the planning board which consists of a set of three pockets for each machine; the lower pocket for cards covering jobs ahead, the middle pocket for the next job, and the upper pocket for the card covering the job being worked on. From the planning board the foreman or superintendent determines the volume of work ahead of each machine and is thus greatly assisted in keeping in close touch with operating conditions.

Planning and close supervision by department superintendents is absolutely necessary to secure increased labor efficiency, and each employee's work is so planned that he is kept at his own work and not required to wait around for the foreman to look up equipment and material before being able to start the next job.

The starting and finishing times, also the clock numbers of the employees working on the job, are entered in the spaces provided for this information on the Labor Service Cards and at the end of the turn these cards are sent to the pay-roll department, together with the Foreman's Force Reports, and are used for the distribution of the time to the proper work orders. By sorting these cards with the Hollerith sorter and then filing them behind a guide card, it is possible to obtain accurate and prompt information relative to the status and cost of each work order.

The first copy of the Labor Service Card, after being rated and extended, is returned to the department issuing it, and the second copy is sent to the department superintendent or foreman being charged with the labor. The purpose of sending the second copy to the department charged with the work is not only to advise the foreman as to the progress of the work but also to give him an opportunity promptly to raise any question as to the correctness of the charge.

The third copy of the Labor Service Card, which is a Hollerith card, is used for cost purposes as stated previously.

Distribution Card for Producing Departments—Form K

After the Foreman's Force Report (Form G) has been completed as explained in the previous paragraphs, a Hollerith card (Form K) is punched from this report showing the following as illustrated by lines 7 and 8:

Date.
Pay-roll number.
Final charge account number.
Man hours.
Actual cost.

These Hollerith cards, together with the third copies of Forms I and J, constitute the pay-roll distribution for the day, and after being punched are run through the tabulator and the total of the cards balanced with the total of the detail postings to the pay-roll (Form M—Fig. 3) as explained later. From these same cards a report can be compiled very quickly, showing the total hours charged to each department, which, when charted with the daily production, gives a good index of the daily efficiency of the department. This plan renders it possible to secure this information the afternoon of the next day. The cards are then filed by cost and distribution classes until the end of the month when they are ready for posting to the monthly cost sheets, this method making it possible to complete the operating cost sheets by the fifth of the following month

Daily Pay-roll Balance Sheet—Form L

To this sheet are posted the totals of the [illegible] labor distribution as shown by the Hollerith cards, Forms I, J, and K, which are balanced with the [illegible]

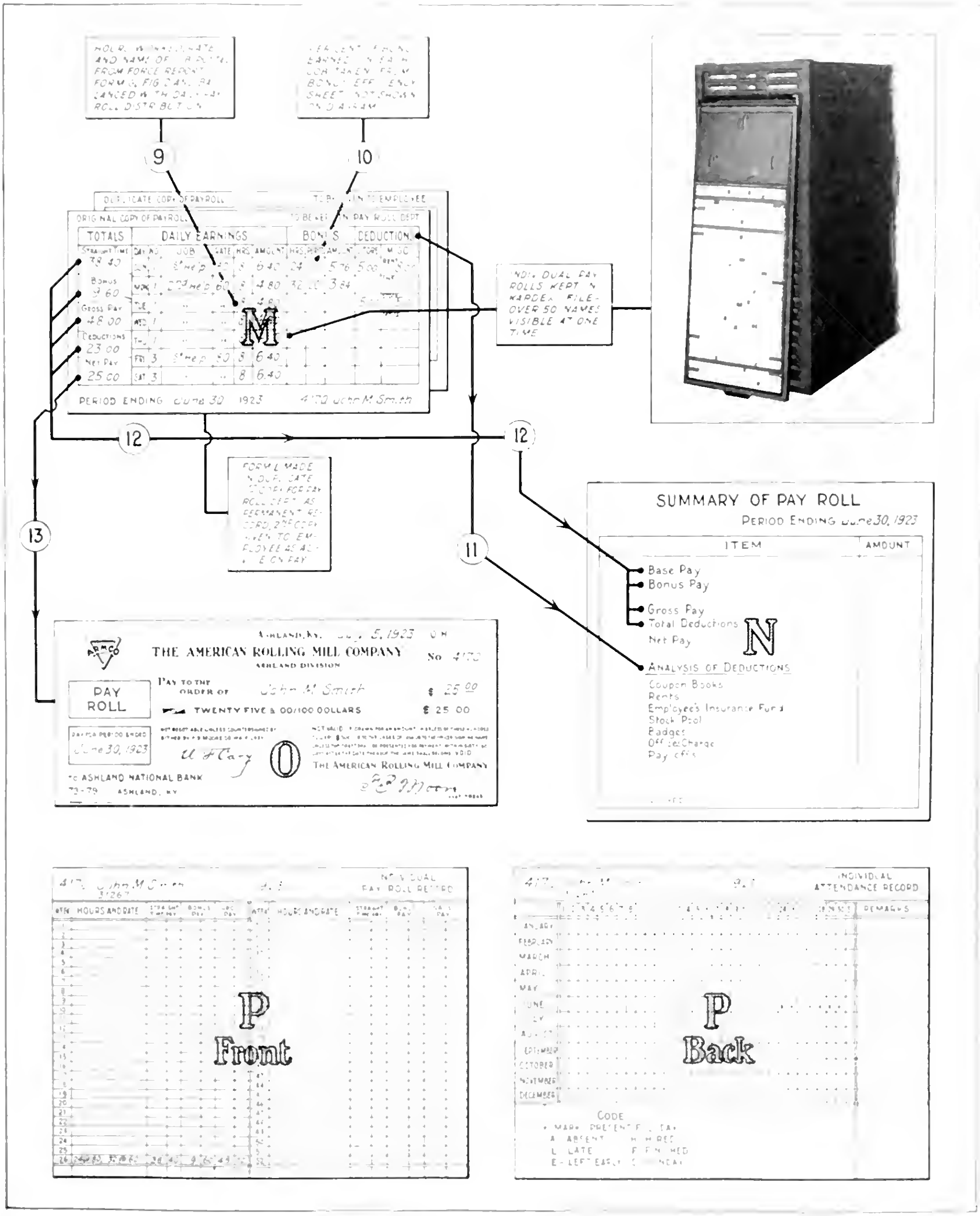


FIG. 3 COMPILATION OF PAY ROLLS

of the detail postings to the pay-roll. This form is made in three copies showing the pay-roll for all departments in the plant and distributed as follows:

Cost department.
General superintendent.
Pay-roll department.

The first copy, sent to the cost department, is retained by this department as a proof of the balancing of the distribution cards with the daily pay-roll as explained above. The second copy is used by the general superintendent for statistical purposes and for information as to the daily expenditure for labor in each department, while the third copy is retained for reference in the pay-roll department.

The Compilation of Pay-rolls—Fig. 3

The Individual Pay-roll (Form M) consists of two copies and a sheet of carbon-back paper folded together so that the carbon-back sheet comes between the two copies. These forms are made on the addressograph, the stencils showing the clock number, serial number, and name of employee. The individual pay-roll forms are then placed in a Kardex file similar to the one illustrated in the diagram, which has proved to be very satisfactory for this class of work. By the aid of this visible file, it is possible greatly to speed up the work of posting the pay-rolls and it keeps the forms in perfect condition.

Each day, after the Foreman's Force Reports (Form G) have been checked with the clock cards as already explained, the following information is posted from this report to the pay-roll as illustrated by line 9 of the diagram:

The furnace or turn number.
Brief description of job.
Rate per hour.
Hours worked.
The daily earnings extended and entered in the column headed "Amount."

After all postings are made for a department, the comptometer operator totals the cards for that department, for both hours and amounts, these totals requiring to balance with the totals shown on the Foreman's Force Report (Form G) and also with the total of the distribution cards (Forms I, J, and K). As this verification embraces hours, rates, extensions, and totals, it is possible to insure that the employee will be paid the proper rate for the job on which he was working.

This same procedure is followed for each day of the week, and at the end of the week when all daily entries have been made to the pay-roll (Form M) the total hours and amount of straight time pay are entered to the left of the form in the space provided.

In order that the employee may fully appreciate the amount that is paid to him in the form of bonus and for what it is paid, complete information relative to the figuring of the bonus is posted to the pay-roll, this data being taken from the weekly bonus report. The latter shows the per cent of efficiency on each job, which is obtained by dividing the actual hours by the standard. The hours worked on each job, as shown by the daily postings from the force report, are then carried to the bonus column and multiplied by the per cent of bonus earned and the rate per hour, the bonus amount being posted in the space provided for the same. In the illustration as shown on the diagram by line 10, the employee worked 24 hrs., first as helper at a rate of 80 cents an hr., and for each hour earned 30 per cent additional on his base rate or an amount of $5.76. The total bonus for each department is posted to the Pay-roll Balance Sheet (Form L—Fig. 2), and also distributed to the proper accounts for cost purposes.

All charges against the employee are posted to the pay-roll as soon as possible after they occur so that if the employee's account is overdrawn or if he should leave the employ of the company, this information will immediately be brought to the attention of the paymaster. On Form M, as shown on the diagram, a column has been provided for the daily posting of charges from the store, so that by comparing these charges with the daily earnings it is possible to determine whether or not the account is being overdrawn.

As the deductions are posted and balanced, the totals of each class are posted to the Summary Sheet (Form N) as illustrated by line 11, the total for each class being entered under its proper heading. The total of the deductions for each employee are carried to the left of Form M in the space marked "Deductions."

After the straight time pay, bonus pay, gross pay, deductions, and net pay have been entered in the spaces provided at the right of Form M, a grand total is made of straight time pay, bonus, and deductions and posted to Summary of Pay-roll (Form N) as illustrated by line 12. The grand total of the gross pay for the department should then balance with the total as shown on Form L of Fig. 2. The net pay shown on Form N is the amount actually paid to employees.

When the pay-roll is balanced the gross earnings for each employee are posted to the Clock Card (Form E—Fig. 1) and this clock card, together with the duplicate copy of the pay-roll (Form M), is given to the employee two or three days previous to pay day. The duplicate copy of the pay-roll gives the employee complete details of his pay, this duplicate being retained by the employee as his record. The clock cards are signed and handed to the paymaster on pay day in exchange for pay checks and are then filed away and serve as an address record for each employee on the pay-roll.

A pay check (Form O) is made for each employee on the Addressograph machine. The net amount of pay is taken from the pay-roll (Form M) as illustrated by line 13.

Form P is for the purpose of showing a summarized record of the earnings and attendance for each employee over a period of one year. The information for this record is posted from the individual pay-roll (Form M) at any convenient time after the period ends. The information shown on this record is of considerable value in making up employees' income tax returns and in the preparation of statistics for use in wage negotiations.

The Monthly Financial Budget

"How the Walworth Company Looks Ahead"—Article Four—Part II

By JOSEPH H. BARBER

Staff Assistant to the President, Walworth Manufacturing Company

Class Number
338.97 Forecasting Production
657.524:658 Cost Control

THE detail and total summary schedules described in the first part of this article are built up in a direct line from the estimator's own, or revised, detail. They are the foundation directly underlying the master summary schedule (Table 8) which is comprised only of master columns copied directly from the other summary schedules. The significance of such a building up process is emphasized by the consequent increased utility of the master summary, in the light of its subsequent analysis to be described.

TABLE 8. JULY 1923, BUDGET, WALWORTH MANUFACTURING COMPANY AND SUBSIDIARIES

	Billing	Purchases	Pay-rolls	Cash Receipts	Cash Disbursements	Inter-unit Billing	Inter-unit Purchases
	A	B	C	(D)	E	F	(G)
(1) General office expense	$	$00,000	$00,000	$000,000	$000,000	$	$ 000
(2) Munzing debentures				00,000	00,000		
(3) Eastern division	000,000	00,000	0,000	000,000			00,000
(4) Boston works		000,000	000,000			000,000	00,000
(5) Western division	000,000	0,000	00,000	000,000	000,000		00,000
(6) Kewanee works		000,000	000,000			000,000	00,000
(7) Boston branch	000,000	00,000	00,000	000,000		000	00,000
(8) New York	000,000	00,000	00,000	000,000	00,000	000	00,000
(9) Chicago	000,000	00,000	00,000	000,000	00,000	000	00,000
(10) Seattle	000,000	00,000	0,000	000,000	00,000	0,000	00,000
(11) Philadelphia	000,000	00,000	0,000	000,000	00,000	000	00,000
(12) Portland	000,000	00,000	0,000	000,000	00,000	0,000	0,000
(13) Total branches	000,000	000,000	00,000	000,000	000,000	00,000	000,000
(14) Walworth International Co.	000,000	00,000	0,000	000,000	000,000	..	000,000
(15) Walworth-Ohio Co.	000,000	00,000	0,000	000,000	000,000	..	000,000
(16) Walworth-Munzing	000,000	00,000	0,000	000,000	00,000		00,000
(17) Total	0,000,000	000,000	000,000	0,000,000	0,000,000	000,000	000,000
(18) Total pay-roll (add)		000,000					
(19) Inter-company (deduct)				000,000	000,000		....
(20) Total	0,000,000	0,000,000		0,000,000	0,000,000		
(21) Financial expenses		(a) 00,000					
(22) Total	0,000,000	0,000,000					
(23) Cap. and other charges		(b) 00,000					
(24) Total	0,000,000	0,000,000					

(a) Financial Exp. Includes:
$ 0,000 for Int. on Notes Payable
00,000 for Int. on Bonds (Book Chge. Only)
0,000 for Insurance
0,000 for Wal. Realty Rental and Taxes (Book Chge. Only)

$00,000

(b) Capital and Other Chgs. include $00,000 Walworth-Munzing debentures.
(c) None of the figures on the budget indicate the effect of any proposed note transaction.
Planning and Statistics Section, Boston, June 26, 1923.

When these subordinate summary sheets are reviewed between the twentieth and twenty-fourth of the month preceding the performance month, they are inspected by the minor executives or by the major officers, as individuals, each responsible for execution of some phase of the whole program. After the details have thus been reviewed and have finally been summarized in the master schedule (about the twenty-fourth of the month preceding the budget period), the master schedule is presented to an advisory committee, which counsels the president in all of his decisions. This advisory committee is composed largely of the same general office major executives, who have previously personally reviewed the other summary sheets in which they were particularly interested. Therefore, in committee meeting, each executive is in a position to respond intelligently to policy questions which may be raised concerning his phase of the program.

Moreover, it is now readily observed that, because the method of building up this master sheet makes possible the reverse process, a breakdown to original detail may be made at any point in the completed picture where there appears disproportion. Therefore, if, during the advisory committee meeting on the twenty-fourth or twenty-fifth, more than a general answer to a policy question is desired, there is much pertinent data at hand, and consequent precision in deciding who, or what, to ask while there is yet time to direct proper influence where needed.

Our next interest, then, is in the master summary analysis which "determines advisability" and in the consequent action which "insures desirability."

The Analysis of the Master Schedule

The master summary presents a coordinated picture of all the anticipated activities of the company, except that the production program is reflected only in the purchases and pay-roll items of the two works. These works items in the monthly budget are supported by detail schedules of the month's expected charges for labor, etc., and such detail is very useful. But a better picture and a more definite control of proposed production is secured from the quarterly sales requirements estimate and from the monthly "Proposed Operations" summaries, referred to in the third article of this series.

On the other hand, along all other lines, the analysis of the master budget does yield much interesting and definite advance information. Probable operating profit for the month is observed at a glance by subtracting from the column "A," line 22, total of expected sales, the column "B," line 22, purchases and pay-rolls total (which includes "Financial Item,"[1] but excludes "Capital Charges"[2]). It is these columns, on the "accrued" basis, which reflect roughly probable cash conditions 60 days in advance. For the "close up" view, columns "D" and "E" give a picture of cash conditions to be expected in the coming month.

The purchasing and selling, however, cannot be carried on without interunit exchange of material. Therefore, for better analyzing the conditions of any single unit as a separate business, the interunit sales and purchases are listed in columns "F" and "G."

From this "set-up" there can then be observed for each unit, upon a single line across the sheet, a summary of its condition as an individual entity. Sales to customers, plus interunit sales, represent income. Purchases from outside vendors, plus pay-roll, plus interunit purchases, represent total commitments made for securing the sales of the month. Consequently, a comparison of these commitments against the sales, after deducting estimated profit on sales, shows just how much each unit may be increasing or decreasing its inventory.

Such an analysis of the master schedule is shown in Table 9. The purpose of this schedule is to reveal the extent of seasonal overcommitments (inventory increase). The overcommitments of each unit, as reflected in the cumulated budget estimate and budget report figures for the most recent months, are added to the latest available auditor's year-to-date records of inventory increase or decrease.

This particular "Interpretation Schedule" is being issued with the master schedule during these current months of 1923 when it is so vital to watch inventories. A glance at the most recent "H" column, and its predecessors, quickly tells a story, which is *the* important story just now. However, as the importance of inventory control ceases to be the major interest, and as some other phase of control—say reduction of expense—becomes the major concern of current control, this present "Interpretation Sheet" may be superseded by some other that will emphasize what appears at that time to be the most important phase of control.

On the other hand, the form of the single master summary, as finally adopted two years ago, is unchanged. And one of the most fruitful results of

[1] The column "B," line 21, "Financial Items" amount includes regular treasury department operating charges, not in the nature of regular operating expense of the general office as such. These charges, however, become charges to the operating units and must therefore be included in any total of commitments referred against sales.

[2] The column "B," line 23, "Capital and Other Charges" item, covers obligations which are in the nature of asset form changes and which do not result in charges to the operating units. Although this information is not significant from the standpoint of budgetary control of income and outgo, to be discussed here, it has been wise to include it in our monthly summary.

TABLE 9. JULY 1923, YEAR-TO-DATE COMPARISON OF COMMITMENTS AGAINST SALES INCOME

(Audited to April—Preliminary May Report—June Revised Estimate and July Preliminary Estimate)

COMPUTED JUNE 26, 1923

(In Thousands of Dollars)

ALL UNITS (G. O. Regular Distributed To Sales Units)	JAN.-APR. ACTUAL INVENTORY INCREASE OVER DEC. 31, '22 (AUDITOR'S)	MAY, JUNE AND JULY COMMITMENTS			MAY, JUNE, AND JULY SALES INCOME EXCLUDING PROFITS				1923 YEAR-TO-DATE EXCESS OF COMMITMENTS OVER INCOME (Approx Increase in Inventory)			
		Purchases Incl. I/C & Chgs. from G.O. (Excl. Cap & Other Chgs.)	Total Pay-roll Charge	Combined Purch. and Pay-roll	Total Sales to Cust. and Int.-Co.	Anticipated Profit: Estimated Per cent Profit Margin	Anticipated Profit: Dollar Profit Amounts	Sales Income Less Expected Profit	July to Date: Visible as of 6/26	June to Date: Visible as of 6/15	June to Date: Visible as of 5/24	May to Date: Visible as of 5/18
	AA	A	B	C (A + B)	D	E	F (D×E)	G (D − F)	H-9† AA+C−G	H-8†	H-7†	H-6†
Eastern division	$00	$000	$000	$0,000	$0,000	00	$000	$0,000	$00	$00	$00	$00
Western division	000	0,000	000	0,000	0,000	00	000	0,000	000	000	000	000
Boston branch	00	000	00	000	000	00	00	000	000	00	00	00
New York	00	000	00	000	000	00	00	000	00	00	00	00
Chicago	00	000	00	000	000	00	00	000	00	00	00	00
Seattle	00	000	00	000	000	00	00	000	00	00	00	00
Philadelphia	00	000	00	000	000	00	00	000	00	00	00	00
Portland	00	000	00	000	000	00	00	000	0	00	0	00
Total branches	000	0,000	000	0,000	0,000	...	00	0,000	000	000	000	000
Walworth International Co.	*00*	000	00	000	000	00	00	000	*00*	*00*	*00*	*00*
Walworth Ohio Co.	00	000	00	000	000	00	00	000	00	00	00	00
Walworth-Munzing	00	000	00	000	000	00	00	000	*00*	*00*	*0*	00
Grand Total	000	0,000	0,000	0,000	0,000	...	000	0,000	000	000	000	000
* Capital and Other Charges (only G. O. Expenditure not Distributed to Sales Units)									*000	*000	*000	*000
Final Commitments Excess Total									0,000	0,000	0,000	000

† The number following any column identified by "H", suggests that the figures therein have been copied over from the "H" columns of the first, the second, or later issue of this tabulation.

* *Capital and Other Charges Include the following:*

Jan. $00 Munzing
00 Wal. Realty
00 Phila. "
$00

Feb. $00 Cleveland
00 Wal. Realty
$00

Mar. $00 Pref. Div
00 Com. "
00 Wal. Realty
$000

Apr. $00 Wal. Realty
May 00 Wal. Realty
June 00 Pref. Div.
00 Com. Div.
000 Reduct. Bond Principal
$000
July 00 Munsing & Co.

Planning and Statistics Section,
Boston, June 26, 1923

Total Capital and Other Charges Listed...... $000 analysis of this master schedule will always be that the treasurer can more advantageously dispose his funds, can pay off current notes payable, if possible, or can on the other hand, arrange to secure only such additional funds as will find profitable use.

The fourth requirement upon budgetary control is to "insure desirability." The analysis before, and during the advisory committee meeting, indicates specific cases where controlling influence should be brought to bear. Such corrective action, however, is not necessarily initiated only by committee recommendation. If the reviewing executive, prior to committee meeting, recognizes the opportunity to secure a desirable revision from his subordinate, he initiates correspondence immediately. The executive is then in a position to inform the committee of suitable pressure already directed.

Here it is well to state that we feel that the line officer is the logical channel for effective control. The staff executive's function is to convince the line officers "what facts are facts," and to recommend action upon the basis of these facts. If the staff executive cannot "sell" the major line officer personally, he can little hope to "sell" the subordinate through correspondence. If he does "sell" the superior, and if in natural consequence, that superior utilizes his authority, control is then assured.

Revision of Policies

Again, the form of the master budget reflects the form of organization. As stated, in a very definite sense each unit is treated as a business by itself. The manager is largely free to adopt his own detail ways and means. Upon the assumption that he is a responsible manager, possessed of more than average judgment, he is not policed as to these details, but he is expected frankly to lay his "cards on the table" for review by his friendly superiors. The first assumption is that his desire is always for the company's best interests, and that no one is more anxious than he to receive correction of his proposed policy if it fails to conform to the needs of the company's situation as a whole.

The natural consequence of this policy is that the control measures "to insure desirability" consist almost wholly in convincing the subordinate executives of the necessity for revision in their policies. If these executives are thus convinced, the details will care for themselves. Thus, our "budget" is not a budget if that term be reserved to describe only the "when-approved-becomes-an-appropriation" type, so common with institutions of essentially fixed income.

In practice, then, our approval, or revision, of any estimate is in the light of our absolute dependence upon the local executive and of our assurance of his cooperation in our plan for the future. For instance, if inventory liquidation is desired, we depend upon him to limit forward commitments long before we can "spy out" overcommitments through any form of "appropriation" type budgetary check-up.

As a consequence, if overcommitments are avoided, the later purchase invoices to be received, as reflected in

TABLE 10. COMPARISON OF [illegible] ACTUAL WITH ESTIMATE
NEW YORK BRANCH

Item	Schedule [illegible]	Actual	Estimated	Per Cent Inc. or Dec.
1	Amount of other O. S. sales to customers	$00,000	$00,000	0
2	Amount of pipe sales to customers (self owned and consigned)	00,000	00,000	0
3	Total O. S. Sales to customers (Items No. 1 and 2 comb.)	00,000	00,000	0
4	Amount of D. S. pipe to customers	0,000	0,000	0
5	Amount of all other D. S. sales to customers from O. V.	0,000	0,000	0
6	Amount of all sales from Inter-Co. sources	00,000	00,000	0
7	Total D. S. sales to customers (Items No. 4, No. 5 and No. 6 comb.	00,000	00,000	
8	Total billings to customers (Sum of Items No. 3 and No. 7	000,000	000,000	
9	Billing against other units of the company	0,000	0,000	
10	Cash receipts from collections of customer's accounts, notes, etc.	000,000	000,000	0
11	Cash receipts from other outside sources, if any	000	000	0
12	Total	000,000	000,000	0
13	Cash disbursed to other units of the company	0	0	
	Schedule II-4 A			
1	Purchases from O. V.-Stock, etc., except that included in Item No. 2	00,000	00,000	0
2	Purchase cost of all owned and consigned pipe O. V.	00,000	00,000	0
3	Purchase cost D. S. pipe from O. V.	0,000	0,000	0
4	Purchase cost D. S. from O. V. except pipe	0,000	0,000	0
5	Extraordinary purchases equipment pd. by G. O.	0	0	0
6	Extraordinary purchases equipment pd. by Branch	0	0	
7	Deferred charges	000	000	
8	Total purchases from O. V.	00,000	00,000	
9	Inter-company purchases of all mdse. for stock	00,000	00,000	
10	Inter-company purchases of all groups for D. S.	00,000	00,000	
11	Total purchases	000,000	000,000	
	Schedule II-4 B			
1	Pay-rolls (Salary)	0,000	0,000	0
2	Pay-rolls (Wage)	0,000	0,000	0
3	Pay-rolls (Commissions)	000	000	0
4	Expense purchases—O. V.	0,000	0,000	"
5	Expense purchases—general office	0,000	0,000	"
6	General office expense apportioned	000	000	0
7	Other inter-company expense	000	000	0
8	Fixed charges	0,000	0,000	"
10	Credits to expense			0
11	Total branch expense	00,000	00,000	0

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later budget estimates, will not be excessive. And, finally, if invoices received are in control, the cash situation will largely take care of itself.

A further adherence to this general policy is found in our willingness to "accept revisions." We recognize that some of our unit executives estimate under difficult conditions. Practices of the trade over which the estimator has no control may greatly affect his estimate. Moreover, it frequently happens that some of our western units find that materials for which they have committed themselves long in advance are delivered earlier, or later, than expected. Also, the works after having covered themselves for certain raw materials are later satisfied that delivery may be safely delayed, thereby postponing the set-up of liability and the payment of cash.

In such cases, the units are instructed to request revision of their estimate and their revisions are accepted. If these revisions are sufficiently large materially to alter plans, the treasurer or others interested are advised of these major revisions subsequent to issue of the budget for the month.

In the initial paragraph of the first article of this series, we stated this reason why we are "sold" on the value of budgetary methods: "The slight expense involved becomes an investment in the light of profits that are not lost, and losses that we really profit by."

Lifeless, indeed, must be the budgetary procedure which fails to check performance against estimate. The growth possible through observed experience is far beyond any development possible through initial planning (or "dreaming") only. It is at once assumed as axiomatic that this growth through observed experience is possible only:

1. If there is a willingness, upon the part of all, to learn, and;
2. If subordinate, as well as major, executives are constantly developing capacity.

We must assume that this willingness to learn does extend to the unit managers and department heads who estimate for the budget. Indeed, in our case, the actual improvement in their estimating proves this to be a fact. Undoubtedly, this improvement in each individual executive's estimating is not a little due to his analysis of the complete check-up reports submitted to him after preparation by the planning and statistics section from the auditor's records of performance.

Table 10 shows the form of check-up record of an estimator's actual performance compared with the estimated performance he originally recorded in Tables 1, 2, and 3, previously shown. When some exceptional condition causes the variation between the actual and the estimate, this is explained by a footnote inserted upon the check-up schedule by the planning and statistics section. Ordinarily, of course, the estimator will have previously informed the section of the cause of the variation, in which case the footnote is simply a reminder record.

The percentage variations, shown in Table 10, are also graphically portrayed in charts sent to the estimator. Such experience records not only provide the stimulus to better estimating, but also provide a handy source of data concerning the estimator's past performance, which must be his guide to future performance.

The checking-up process, with the major officers, assumes the form of daily, quarter-monthly, and end-of-month statistical reports of performance upon many phases of the various activities.

Only one of these statistical reports of the current performance is shown here. Table 11 shows the form of our "Budget Report" of actual performance, prepared with the expenditure of but a few hours' time every quarter-month. This report shows the officers, currently, how closely performance is meeting the estimate. Except for the addition of a footnote showing to what extent notes payable have been increased or paid off by the treasurer, these quarter-monthly budget reports are set up in exactly the same arrangement as the master estimate for the month, so that direct comparison, item by item, and unit by unit, can be made.

These reports are cumulative. The first report on the eighth normally would represent one-quarter of the month's business; the second report on the fifteenth would represent one-half of the month's business; the third report on the twenty-third would represent three-quarters; and the end-of-the-month report would show how closely the estimate anticipated the actual month's business. Of course, in practice, there are many exceptions, to which we quickly become accustomed. We know of the cash discounting conditions which bring two-thirds of the cash receipts and cash disbursements within the first 15 days, and of factory conditions which cause one-third of their billings to occur in the last quarter of the month. Such knowledge is developed by the observed experience possible through adequate current reporting.

Space will not permit discussion here of the principles governing the full statistical reporting service, which the planning and statistics section furnishes the executive officers for their current information and guidance. This will be the concern of the concluding article of this series. But, as a part of the budgetary procedure, it is here emphasized that the officers who are continually burdened with the necessity for immediate decision upon questions affecting maturing

TABLE 11. QUARTER MONTHLY BUDGET REPORT, WALWORTH MANUFACTURING COMPANY AND SUBSIDIARIES
First Twenty-three Days of July 1923

	BILLING	PURCHASES	PAYROLLS	CASH RECEIPTS	CASH DISBURSEMENTS	INTER-UNIT BILLING	INTER-UNIT PURCHASES
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
(1) General office expense	$	$00,000	$00,000	$00,000	$000,000	$	$ 00
(2) Munzing debentures							
(3) Eastern division	000,000	0,000	0,000				00,000
(4) Boston works		00,000	000,000	000,000		000,000	00,000
(5) Western division	000,000	00,000	0,000	000,000	000,000		00,000
(6) Kewanee works		000,000	000,000			000,000	00,000
(7) Boston branch	000,000	00,000	0,000	000,000		000	00,000
(8) New York	000,000	00,000	0,000	000,000	00,000	000	00,000
(9) Chicago	000,000	00,000	0,000	000,000	00,000	000	00,000
(10) Seattle	00,000	00,000	0,000	00,000	00,000	0,000	00,000
(11) Philadelphia	000,000	00,000	0,000	00,000	00,000	000	00,000
(12) Portland	00,000	00,000	0,000	000,000	00,000	0,000	0,000
(13) Total branches	000,000	000,000	00,000	000,000	000,000	00,000	000,000
(14) Walworth International Co	00,000	00,000	0,000	000,000	000,000		00,000
(15) Walworth-Ohio Co.	00,000	00,000	0,000	00,000	00,000		00,000
(16) Walworth-Munzing	00,000	00,000	0,000	000,000	00,000		00,000
(17) Total	0,000,000	000,000	000,000	0,000,000	0,000,000	000,000	000,000
(17A) July estimate	*0,000,000*	*000,000*	*000,000*	*0,000,000*	*0,000,000*	*000,000*	*000,000*
(18) Total pay-roll (add)		000,000					
(19) Inter-company (act.) (deduct)				00,000	00,000		
(19A) Inter-company (est.)				*000,000*	*000,000*		
(20) Total	0,000,000	000,000		0,000,000	0,000,000		
(21) Financial expense (act.)		00,000					
(21A) Financial expense (est.)		*00,000*					
(22) Total	0,000,000	0,000,000					
(23) Capital and other chgs (act.)		00,000					
(23A) Capital and other chgs (est.)		*00,000*					
(24) Total	$0,000,000	$0,000,000					

Notes payable as of June 30, 1923		$000,000
Additions this month to date	$00,000	
Paid this month to date	00,000	
Net decrease		00,000
		000,000
Renewed this month to date		00,000
Balance of notes maturing during July, 1923		0,000

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plans, must have at hand a simple summary of latest current performance against estimate, and, likewise, must have at quick call a fund of detail current information concerning particular matters of interest.

In thus considering how we satisfy the fifth requirement of budgetary procedure, that is, the "checking up of ability," our discussion has completed a circle. For, after suggesting that the modern administrator, no less than his forerunner, must "see how things are going," we emphasized that, under the device of budgetary control, not only does the administrator know that he "sees," but also the estimator knows that he is being "seen" by a manager who is in constant touch with planned and actual performance.

The final estimate of value placed upon any such business procedure must necessarily be in terms of added profits. How, then, does this procedure justify its existence?

Estimated and Actual Performance

Fig. 1 indicates the 1922 monthly estimated performance against actual performance. Ratio plotting is used so that percentage variations are reflected, and so that the relative fluctuations of all lines may be observed. The chart confirms the confidence reposed in the budget as a basis for policy decisions. It is true that sales and collections estimates tend to be conservative, and that single monthly results, for some items, show discrepancies at times as high as 8 per cent or more. These, fortunately, are the items less essential than others for policy determination. Nevertheless, in the case of all items the average, over a few months, shows fair accuracy. The close average performance on all items indicates that, as the budget is used over a period of months for policy forming, it serves as an accurate instrument for guidance.

If such a guiding instrument is necessary, if it performs its necessary function better than other devices have, and if it thus serves economically, we then have all the elements of value. And, in terms of added profits, if the service enables the administrator to co-ordinate the operations of all departments so that profits are larger than they would be without the service, then it is evident that the service itself contributes to the added profits.

Sustaining these points, our President says: "Budgetary control is now one of the fundamental policies of our company. It is our record of the past, our index for the present, and our guide to the future. We believe it to be an essential factor in our success."

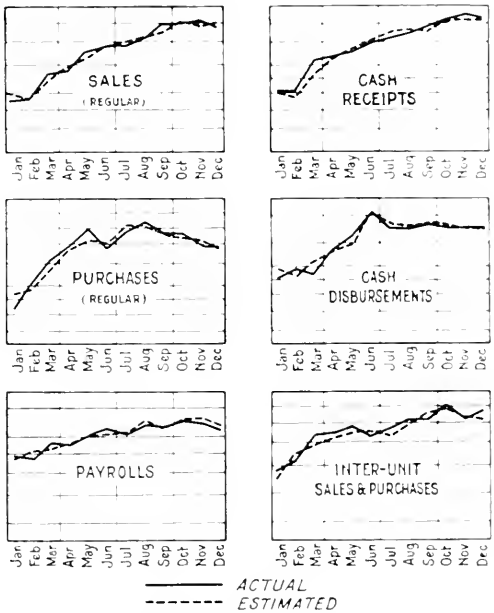


FIG. 1 MASTER BUDGET PERFORMANCE FOR 1922

Executives I Have Met

By BILL HALEY

Foreman

Class Number
658.4121 Executives

At times every executive wishes he could see himself as his workmen see him. Having worked under the supervision of many types of men, I recall some of the impressions they made upon their employees, and what opinions the peculiarities of the boss created.

First, we will consider the case of the executive of a large plant located in New Jersey. When arriving on the job, I was promptly taken in hand by one of those fellows who feel that it is their duty to show the newcomer the "ropes." The first morsel of advice was to be very careful not to incur the wrath of the big boss before he had breakfasted. "Don't rub his fur the wrong way before he goes out to get his 'coffee-and,' but when he gets filled up he is a pretty good sort. He has fired many a man who bothered him before breakfast."

Somehow or other it did not seem quite right to me that a man's security should hinge upon such a small factor, but after I was there a short time, I found that such was the case. I often noticed that the salesmen took advantage of his failing, also. Of course, the employees of this concern were always on the lookout for more secure positions, where the factor of temperament before breakfast did not enter into account.

As a contrast to this "bear before breakfast," I worked for a fellow who was a jolly sort of person all day long, but he was reputed to be unmerciful and unforgiving to an erring underling. As long as everybody was on the job, he was as cheerful as a robin, but let something go wrong and he would "tie a can" to the offender on the spot—not with a loss of control of temper, but with a cheerful smile.

Yet even the greatest men have their little weaknesses, and this fellow was reputed to have a very soft heart after dinner. The big salesmen had this fellow's number, too, we noticed, and it was easy to get his name on the dotted line immediately after a good meal. Those who were fired for some slight mistake in the morning were generally hired back, if they were clever enough to look him up after he had paid his dinner check. One fellow claimed to have been hired and fired four times.

This boss got the work out, though, and he had a wonderful organization—everybody on their toes. I never saw him without a smile. The reader is most likely acquainted with several persons of this type, but I have worked for only one. Frankly, it was a pleasure to work under him, if you knew your business thoroughly. If you did not, you would not last long.

The Man Susceptible to Flattery

Another executive whom I worked under was quite susceptible to flattery. There never was the least doubt among those who worked under him, that he did not know his job. He certainly did, from A to Z. Yet it was so frequently remarked that those who flattered him most, fared best, that compliments used to be heaped on him from all sides. Through this weakness, he had a tendency to maintain as foremen, persons who were more capable as flatterers than they were as supervisors, and this was his undoing. The last I heard of him, he was "back with the tools," but I am quite certain that at his own craft he is without a peer, in relation to both theory and practice.

I must not forget to mention a man I once worked under, whom I never was able to fathom. He regarded all the men directly under him as we regard our family. Should an employee get hurt, or be sick, he was sure to be up to the hospital to see him at least once a week. If any of his men were in any sort of trouble, financial or otherwise, he was the first to offer aid. He could not seem to be contented until that man was back on the job, and he had a wonderful memory.

I remember having left his employ to work elsewhere for a period of three years, and the first day I was back on the job, he wanted to know how my youngster was getting along. "I remember you told me that he was very sick the day you left our employ," he remarked. Can you beat that? If a man takes that much interest in your welfare, can a fellow help reflecting the same spirit? No wonder the crowd is all hoping that he will send for them to come down to Panama to his new job on the canal. The gang used to call him "Bingy," and though that is not his name, I am certain that there are thousands of electricians and electrical engineers scattered all over the country who will recognize the nickname.

I well remember a plant I once worked in where the executive gave strict orders to keep the help segregated from the minor executives. He maintained that familiarity among the workmen bred contempt. Yet there came a time when the "long-distance boss," as he was dubbed, needed the co-operation of the workers, and though the minor executives started to fraternize with the help, it was too late. A competing organization, with more modern employment methods and a more scientific organization, forced them to the wall and now the competing firm owns or controls the "long-distance" shop. But the executive is there no longer and neither are his methods employed.

In marked contrast to the foregoing organization, was a firm I worked for, which specialized in the construction of submarines. There the name of every workman was known to nearly every executive in the plant. Considering the fact that at one time this plant employed about 2500 men, this statement might sound fishy, but it will stand investigation. True they each had a check number, but, outside of the pay-roll and timekeeping department, the number was seldom used.

There never was any distinction between the heads of departments and the workmen, and it was no uncommon thing to hear the workmen shout a "Good morning" to heads of departments other than the ones in which they were employed, and to have heads of departments return greetings to the men, much as laborer greeted laborer. It is not very often that industrial workers remark that they wish they were back with the old company, but men from this plant did.

The "System Faddist"

There is yet another executive whom I worked directly under, and his methods were rather strange. He was a "system faddist," that is to say, he followed the styles in administration. For a while it was the "cost of production" bug that bit him, next he got a severe attack of "elimination of waste motion" mania, which soon developed into "graphic report-itis" and as time went on he went deeply into the mysteries of utilization of waste products, and then came the prevalent fad of time studies. Among the workmen he had many severe critics. They regarded him as a sort of crank on different subjects and frequently remarked that he should stick to one thing and learn it well.

When all the facts are taken into consideration these critics were wrong. This executive purchased every book on a certain subject and delved deeply until he had mastered the details of each fad. He always maintained that most of these subjects contained much that was superfluous matter and he possessed the knack of eliminating such as was not meat and applying the rest to the job. He almost doubled production in the same amount of floor space, without purchasing any new machinery and at a lower cost of production and a higher scale of wages. Therefore, I could not agree with his critics.

This executive was one of rare ability. Gradually the workmen are coming around to agree with him, and he still adopts every new fad in business and production, and manages to squeeze a profit out of it.

Wage-Incentive Plans for Cost Control

"Increased Profits Through Control of Costs"—Article Two

By R. W. DARNELL

Comptroller, Ritter Dental Manufacturing Company

Class Number
657.524:658 Cost Control
658.551 Wage-Incentive Plan

AFTER the routing system has been properly laid out and all routings established the question of time study must receive consideration. Many managers do not favor time study or an incentive wage-payment, believing that such methods detract from the quality of the work. This is very often the case in plants where proper inspection methods are lacking. In using an incentive plan of wage payment to guard against variations it is absolutely necessary to have accurate blue-prints showing tolerances, limits, and standards of finish, and as a matter of good practice, regardless of whether a plant is working day work or on some plan of wage incentive, these accurate blue-prints and standards of finish should be maintained. These safeguards are seldom employed in a day-work plant with the result that when wage-incentive plans are installed the quality of output begins to decline. Then the incentive system is blamed instead of the loose methods of maintaining specifications.

Another reason why incentive systems are unsuccessful in some plants is the failure to provide a suitable check and follow-up on the system. More money is usually spent in trying to correct the mistakes resulting from operating without proper checks than it would cost to establish and maintain an intelligent system of control.

Cost control of a manufactured part or product involves cost control of its constituent elements—labor, material, and overhead. A properly planned wage-incentive system not only enables the manufacturer to know exactly what his direct labor costs should be but if they exceed this enables him to tell just where the increased cost was incurred, or its cause.

Effect on Workmen of Wage-Incentive Plan

A far-sighted management recognizes the fact that a wage-incentive system is not complete in itself, but is merely a part of the general system and must be supplemented and supported by an efficient operating organization throughout the plant. As a result of this, conditions surrounding the operation of wage-incentive plans have become much more stabilized, and production can be turned out of as good a standard of quality as by day work. Good managers are also beginning to recognize the human side of the question as they never have before, for there certainly is a human side of the question to consider.

As a matter of practice, workmen under a wage-incentive plan where the rates have been intelligently set, like it far better than they do day work. Not only does it put them on their own initiative and allow them to make more money, but it increases the interest of the job until it really becomes a sort of game which they try to "beat." Most men have more or less sporting blood in them and become deeply interested in anything resembling a game of chance. Under the proper wage-payment system the men have an opportunity to play a game at which they win and never lose, the only question being how much they win.

Under day work there is no such interest, and there is nothing to gain by using initiative other than possibly an occasional raise in pay. The consequence is that the work soon becomes monotonous. From that it goes to dull drudgery, and with the foreman a slave-driving warden, the plant becomes more like a prison, and the work itself, instead of being enjoyable and a really interesting part of life, becomes a dread.

We sometimes wonder why men lay off for no apparent reason other than to lay off. Also we see men throw down their tools at the sound of the whistle and bolt for the time clock and the exits and we say to ourselves—"If they would show half as much speed and enthusiasm about their work as they do about getting out, we would get something done," and again we wonder why it should be so. But those who have worked in day-work shops know *why* if they have not forgotten their own experiences.

The author knows why, because he has worked on the bench on the day-work system, and can remember the dragging time. He, too, welcomed the sound of the quitting whistle and rushed for the doors with the rest of the men. The feeling of relief when outside can hardly be described to one who has never been in a similar position.

But what a change when the plan was placed on an incentive wage-payment plan! It made all the difference in the world. Instead of the days dragging, they hardly seemed long enough, so interested did the men become in their work and the game of earning more money. No more clock watching, no more laying off for no reason. While it was seldom that the writer ever obtained a "ringer"—our shop term for a full two weeks pay—the work became so interesting that it never occurred to him to take a day off. Without a doubt it made him a man of more initiative and resourcefulness and it has done as much for thousands of others.

The first thing to do when starting time-study work is to select competent time-study men. This is a very important step; for the success of the incentive system depends greatly upon the type of men chosen for this work. Unless the right man is in charge, and unless he has high-class men under him, it is far better not to start the plan at all. Whatever ill-repute time-study work is held in today is due to the haphazard and unfortunate manner in which it has been handled in past years by many manufacturers.

They have allowed rates to be set by foremen and superintendents from guesswork or past records of performance. They have taken contracts for work on a competitive basis and then set the rates to fit the contract and still allow a profit. They have taken the most difficult and important phase of factory management and, through ignorance which is pitiful, have roused prejudices among workmen and labor unions which will take years to overcome.

Rates set in this manner could not be correct and in practice caused wild fluctuations in workmen's earnings. Rates which were too high, or rather, seemed too high because the operator made good money, were cut without any investigation as to how the work had been accomplished, or what effort had been expended by the operator; cut simply because the superintendent thought the operator was making too much money. They were always free to cut rates; but to increase a bad rate was another matter, and in default of such increase the workman was forced to exert himself to the point of exhaustion merely to keep up with the requirements, and then he got no suitable reward for his efforts. Under such conditions what confidence could any workman have in the management?

The general result was the creation of a lot of dissatisfied and suspicious workmen who detested the term "piece-work" for they knew it to be unfair. No wonder the labor unions are so much against it.

As a matter of fact when handled right, time-study work is one of the most profitable investments any manufacturer can make, not only from the viewpoint of the direct increase in profits, but because it will give him a working force which will be satisfied and contented with their work and conditions and will have absolute confidence in the management. A force of this kind is one of the greatest assets any manufacturer can have; and it is within his power to have it, if he will only abandon the methods used in the dark ages of 10 or 15 years ago for those of the present day.

Time-Study Requirements

The head of the time-study and rate-making department must be a man of wide experience in incentive systems and modern manufacturing methods. He must be a man whose views command the respect of all those with whom he comes in contact, for the success of the system depends largely upon him. The time-study man selected to take observations on machine work should be one who has served his term as an apprentice machinist, and who also has had actual experience as a machine operator in manufacturing departments, so that he can operate any machine in the shop if necessary. He should also be a toolmaker, if it is possible to obtain such a man.

It may not be so very difficult to obtain a man with the above qualifications, but the search is not necessarily ended there for other good qualities are required. He should, in addition, have at least a high school education, be tactful and diplomatic, and of pleasing personality. These qualifications may seem rather severe, but when the nature of the work is considered, they will not appear so.

If a man is to study machine operations, he certainly should know as much about the work to be studied as the operator he is to observe. In fact, he should know a great deal more, because, while all the operator is required to know on most machine operations is how to operate the machine, and in some cases, how to set up a few of the simpler jobs, the observer must not only know how to operate the machine, but must be able to determine whether the operator is using the correct feed and speed to accomplish the best results. He should also be able to check the set-up for simplicity of manufacturing, and determine whether or not the correct tools are being used.

In nearly all plants when this kind of work is started the operators consider the observer their enemy as soon as he comes into the department, because they believe he is there to beat them if possible, to decrease their earnings, and cause them to work much harder. Foremen very often take the same attitude, for they seem to think the observer is there to "show them up," and are, consequently, afraid of their jobs. If they are antagonized at the start and are not corrected in their views on time studies, they are going to work against the observer in anything he tries to do. As can readily be seen, this condition of affairs will not work to the best interests of the company.

Rate-Making Requirements

Before the observer attempts to set a rate of any kind he should spend two or three days in the department getting acquainted, and explaining what he is to do, and how the system is to operate. He must sell both himself and the system to the foreman and operators before he does anything else.

After he has gained their confidence, he must use the utmost care in setting the rates, so that he gains the reputation of being absolutely fair in his dealings. He should lay all his cards on the table so as not to create suspicion; for the day of gum-shoe time-study work is past. There are, however, always a few operators who are going to mistrust the observer, no matter how tactful and diplomatic he may be. Perhaps they have had experience with observers elsewhere, who were not as fair as they might have been, and consequently, they judge all others to be likewise unfair.

It is this type of operator whom the observer will have to watch more closely, for, as a rule, they are men who are experts on their machines and know all the tricks by which they can gain a high rate. It is to meet such a situation, as much as anything else, that a machine observer must be a machinist, for he must be able to detect all such tricks. After an operator has been caught cheating once or twice he will have more respect for the observer, and is likely to discard his bag of tricks and play square.

Preliminary Time-Study Procedure

After the observer has been selected and thoroughly schooled in the incentive system to be used, he is sent to a department to take a study. When he has established himself, he selects a job for observation. As a first step he will take the foreman and go to the operator running the job, and the three of them will discuss the work. The time-study man will decide whether the job is being run on the right kind of machine, that is, the right type and size of machine.

For instance, if he finds that the operation in question is a drilling job where four holes are drilled, and that the operator is doing it on a single-spindle drill press instead of on a multiple drill, he will refuse to take the time. Obviously, if done on the single-spindle machine it takes four times as long as on the multiple. He will first get the job transferred to a machine that is properly fitted for the work and will then see that the tools are in good condition and that they are suitable for the job. It may be that on this particular drilling operation the hole is $\frac{1}{2}$ in. in diameter, and the time-study man finds that they are using a carbon drill. This is again faulty, for a carbon drill $\frac{1}{2}$ in. or over cannot be run at a high enough speed to drill as quickly as it should. A high-speed drill should, of course, be used so that the machine can be speeded up and the drilling time be reduced thereby. There are certain speeds at which a machine must be run to obtain the best results, and the observer should see that it is running at the proper speed and being fed as fast as the tool will warrant.

When the observer has the machine and tools properly lined up, he will get the correct location of the man's stock. It may be that the operator is having to reach too far for his stock, thereby taking more time than necessary to handle it. If so, the observer will place the stock upon which the operator is working in the most convenient position, so that he can handle it to advantage. If necessary, he will also provide a receptacle for the finished parts and place it in an advantageous position to receive them as they come from the machine.

The job is now all ready to run and the operator is started. Before taking any time studies, however, the observer will assure himself that the operator is familiar with the job and that he is at least a normal operator. If he is below the average, he will take more time than is necessary, and if the time study were based on his work as normal there would be too much time allowed. Then some day a good fast operator might be assigned to that particular job, and being so much better, would make excessive time. On the other hand, if a fast man is timed, the slow or normal operator would never be able to make the time. This must be considered when setting the rate itself.

This matter of checking up the style and size of machine the job is being worked on, as well as the tools and location of stock should not be passed over lightly. It presents an opportunity to make a detailed study of the manner in which the work is actually being performed and the observer should grasp this chance to correct any existing inefficiencies.

The importance of this will be apparent, for the average operator will work on any kind of machine which may be assigned him and with almost any tools which are contained in the set up, and never pause to consider whether the job could be done more efficiently in some other way. He is also very apt to waste a great deal of time in handling his stock to and from the machine. If he gives any thought to the question at all, which is not likely, especially under day-work conditions, usually it is only to the extent of thinking that it is none of his business; if that is the way the foreman wishes the job to be run, the operator will run it that way. The foreman, not being trained along efficiency lines does not see these things, and as a consequence the line-up of the job is never corrected. This is the principal reason, outside of inefficiency on the part of the operator himself, for the costly nature of day-work methods. A great deal of time can nearly always be saved by the correction of such deficiencies, before incentive rates are established.

Another reason why this general observation should be made, and any desirable changes be made before setting the rate is, that if the rate is set on the manner in which the work is being done at that time, it will almost inevitably be too high once the operator gets started working on an incentive. Operators, when they begin working for themselves, are quick to devise ways and means of "beating the rate" by finding a quicker way of doing the work, and they soon eliminate the inefficiencies they have been working under. The consequence is, that their earnings are very high, and they are receiving pay for something to which they are not always entitled. By making a close observation at the time of taking the study, the management retains this gain as a clear profit, at the same time assuring uniform and more accurate rates on the various operations.

Time-Study Procedure

In taking the time of the job, the observer will first divide the operation into elements, or suboperations as they may be called. For instance, if he is timing a drilling operation, the first element would be: "Take piece from container and place in jig, bringing drill to bear." The second would be: "Remove piece from jig and place in container." These elements he will list in the section of the Time Observation Sheet, Fig. 2, marked "Elements," and will number each one. The tools used on each element will be listed, as well as the speed of the machine, its feed and cut, and the limits to which the work must be held. On a drilling operation, some of this data is not taken, but on operations of a more complicated nature all the indicated information is necessary.

When this listing is finished the observer will start taking the time with a stop-watch divided into hundredths of a minute, and will record the time for each element in the section of the observation sheet marked "Time," using a space for each piece observed. If the operation is of a comparatively short cycle—that is, from the time he picks up the rough piece until he lays down the finished piece—he will take observations on 15 or 20 pieces, in which case he will use three or four lines for each element. If, however, the operation is a long one, lasting half an hour or more, it will not be necessary to take time on more than 8 or 10 pieces.

It is sometimes thought unnecessary to take time observations by elements, it being claimed that an over-all time is sufficient. It has, however, proved out in practice that taking an observation by elements has a great many advantages over the over-all method. An important one of these is its convenience in case it is necessary to check up an operation. For instance, if after the rate has been set the operator fails to make the time, a time-study man is sent out to discover the cause of the failure, and he has at hand everything necessary successfully to carry out the investigation. If the operator actually made the time when the study was taken, there should be no reason for him to lose later. Therefore, in checking the job, the observer will take the original time study with him and time it over, using the elements taken in the first place. He may perhaps find that on the first element the operator is now taking 0.25 instead of 0.10, but that all the other elements check up accurately. This method of checking shows the operator exactly where he is losing time. Allow him to correct himself on that particular element, and he is very likely to make his rate.

It is also desirable as a method of creating a standard time in a plant that is manufacturing many small parts, where the nature of the work on these parts is very similar. It will probably be found that handling them from the rough stores box to the jig and from the jig to the finished box is about the same on a great many parts. The time allowed for these elements should be the same on all studies taken on similar parts, and can be taken from a schedule made for that purpose.

The time-study man must observe the time that is spent by the operator for grinding tools, replacing poor tools, etc., and must arrive at an approximate percentage to allow for trouble of this kind.

RITTER DENTAL MANUFACTURING COMPANY, INC

TIME OBSERVATION SHEET

Plant—Machine	Dept. No 3	Date 8-28-23	Part No. P-1375
Part Name—Elbow for Air line			
Material—Cast Brass			Oper. No. 10
Machine—No. 2 W & S Hand Screw Machine			Mach. No. 319

Operation—Center, rough turn thread dia., Drill 1/4 in hole 3/4 in. deep Finish turn thread dia. Face body and undercut. Form radius for seat, and turn 17/32 in. x 48 thread, 11/32 in. long.

Standard Time 1.02	Premium Time 1 30	Prod. Per Hr. 46.	Previous Time 2.50
Studied by Brownlee		Checked by J. W. Coates	
Premium Time O. K. Foreman T. Bennett		Prod. Mgr. C. B. L.	Supt. O. H. Pieper

Remarks

DETAIL

Item No.	Elements	Tools	Speed R.P.M.	Speed F.P.M.	Feed Per Rev.	Cut Depth Per Side Inches	Cut Length Inches	Limits	Time Actual					Time Avg.	Time Allowed
1	Pick up, secure in chuck and start machine...	3 Jawed Chuck and Wrench	...	...	...	...	...	...	0.21	0.23	0.22	0.20	0.23	...	0.20
2	Center	Centering tool bit.	740	48	hd	1/16	1/8	...	0.05	0.06	0.07	0.06	0.05	...	0.05
3	Change.	...	...	...	...	...	...	...	0.02	0.02	0.02	0.02	0.02	...	0.02
4	Rough turn thread dia. 0.538 in. dia.	Rough Hollow Mill 0.538 in. dia	740	121	hd	1/32	15/32	...	0.13	0.14	0.11	0.12	0.11	...	0.10
5	Change......	...	...	...	...	...	...	...	0.02	0.02	0.02	0.02	0.02	...	0.02
6	Drill 1/4 in. hole 3/4 in. deep........	1/4 in. drill ...	740	48	hd	1/8	3/4	...	0.17	0.19	0.16	0.18	0.15	...	0.14
7	Change....	...	...	...	...	...	...	...	0.02	0.02	0.02	0.02	0.02	...	0.02
8	Finish turn thread dia	Turning tool X-slide	740	104	hd	1/32	15/32	...	0.07	0.09	0.10	0.08	0.09	...	0.07
9	Change......	...	...	...	...	...	...	...	0.02	0.02	0.02	0.02	0.02	...	0.02
10	Face body and undercut	Formed facing tool X-slide	740	194	hd	1/16	1/4	...	0.12	0.13	0.11	0.10	0.13	...	0.10
11	Change....	...	...	...	...	...	...	...	0.02	0.02	0.02	0.02	0.02	...	0.02
12	Form radius on end	Radius forming tool.....	740	101	hd	1/32	1/32	...	0.07	0.06	0.07	0.05	0.05	...	0.05
13	Change.....	...	...	...	...	...	...	...	0.02	0.02	0.02	0.02	0.02	...	0.02
14	Turn thread 17/32 in x 18 and withdraw	17/32 in. x 18 die and holder	740	101	hd	th	11/32		0.08	0.07	0.08	0.07	0.08	...	0.07
15	Remove from chuck and place in tray	6 Per Cent Contingencies		...	...	...	...	...	0.16	0.13	0.14	0.12	0.15	...	0.12
															1.02

FIG. 2 TIME OBSERVATION SHEET

Calculating the Rate

After taking the study in this fashion, the observer will figure up the rate which he is to allow for the job. By looking over the time on the various elements he will arrive at an average time taken on each. In the allowance column he places the time he decides is fair. If the operator is very slow, he will probably reduce the time taken. On the other hand, if the operator is very fast, more time is allowed than was taken. These allowances are for the purpose of balancing up the rate to a normal basis, so that the average operator can make the time. The result after these reductions or allowances have been made is the standard time necessary to complete one piece.

This is by no means the time allowed on the job when the rate is set, for if it were, the operator would never make anything, because the time figured so far is the best that can be done on the operation. He now adds the percentage allowed for tool troubles, say 5 per cent; and inasmuch as it is not expected that an operator can keep up at break-neck speed all day without some rest, a percentage is allowed for personal fatigue.

This, perhaps, is 10 per cent for this particular job, but 10 per cent is by no means standard for all work. There may be operations where the parts are large and heavy, and where the cycle of work is short. This would cause the operator to handle a great many heavy pieces in a short time, and the element of fatigue is great. On the other hand, there may be operations where the parts are comparatively small, and the cycle of work long—in other words, the machine does all the work and the operator gets a rest in between pieces. These two cases are the opposite extremes; so the percentage of fatigue varies from 2 to 20 per cent, depending on the nature of the work.

After these contingencies have been allowed an incentive allowance is made of from 15 to 30 per cent; whereby, if the operator works efficiently all day, he can earn 15 to 30 per cent above his day rate.

The percentages mentioned are not added separately to the standard time, but are collected and added as one percentage, which, if the standard time is 1 min., would make the total time allowed from 1.25 to 1.50 depending on the class of work.

When the rate has been calculated, the various divisions at the top of the sheet are filled in, the study is O K'd by the foreman and superintendent and is then ready to be transferred to the routing book.

Requirements of Wage-Payment Plan

The principal requirements of an incentive wage-payment plan are six in number, as follows:

1. Direct and continuing incentive to the workman.
2. Simplicity of operation.
3. Fairness to both employee and employer.
4. Effective control.
5. Adaptability to cost system.
6. Adaptability to the basis on which the incentive rates are to be set.

The object of any wage-incentive plan is primarily to increase production through the wage incentive, and in order to do this, the incentive has to be kept as closely before the operator as possible because it is only through the fact that he expects to earn more money thereby that the increased production is going to result.

There have been many plans worked out in order to provide this incentive to the workman, some more direct than others. Many plants have issued stock to their employees, others give a bonus in cash, once or twice a year. Most of these plans, however, have failed in their object simply because the incentive is not kept constantly before the workman—his weekly pay-envelope does not show the result of his efforts. In the case of a bonus paid annually or semiannually, the only time during that period that it really has any effect upon the operator is probably a week or more before or after the bonus is paid. Then he forgets the whole matter so far as any increase in his production is concerned.

Any plan of bonus or premium paid to workmen for increased production, should be calculated on a daily basis. This should be done by means of time studies used as a basis for setting either piece rates or premium or bonus rates on the individual job in such a way that at the end of the day, or hour by hour for that matter the operator is enabled to tell how much money he is actually making. In this way, and in this way only, will the employer get any real benefit from the incentive created by a bonus paid to workmen. So, for any method of wage payment, outlined for an industry, this question of direct and constant incentive to workmen is probably the most important consideration. The plan should also be considered from a standpoint of simplicity of operation, and—giving due consideration to the other advantages necessary to the success of the system—one should be selected which will be easily handled from a clerical standpoint.

Incentive Wage Plan Must Be Fair

The wage plan selected should be fair to both the employee and the employer, otherwise, one or the other will soon become dissatisfied with the system and its result will not be satisfactory. It is too common a belief among industrial engineers and employers that almost anything can be put over on the employee; and they try to take advantage of his supposed ignorance to install a wage system in which the employer has all the advantage. This idea of the workman's ignorance, as far as the wage plan is concerned, is a fallacy. Although the majority of the employees may not understand the "ins and outs" of a system, there are always a number who are above the average in intelligence and some of these will have the system "figured out" within a week after it is installed. Then if there is anything about it that is "shady," or unfair to the employee, it does not take long for the news to spread. The result is that within a very short time there is general dissatisfaction, and where there is dissatisfaction with a system, that system is not going to be a success.

In selecting or planning a wage-incentive system, it is, therefore, far better to take the middle of the road and play absolutely fair with the employee, giving him what he justly earns through the result of his increased efficiency. If the employer will take this view and lay out his system accordingly, he will find that the actual benefits derived from a fair system will outweigh the paper profits of an unfair system. Not only will he have more actual profit in dollars and cents, but he will have created a satisfied and loyal organization—something which is probably worth as much to an institution as any other asset it may own.

Control and Adaptability of Wage System

Any system, regardless of how well it is laid out, needs constant checking and control so as to operate efficiently and, therefore, economically. This should be kept in mind when selecting the wage-payment plan.

for it is only through a system that provides effective means of control in the factory itself, that the general control of costs will be gained. It is failure here that has caused the ordinary run of cost systems to be generally looked upon as only a means towards better accounting, and not as an agency for reducing costs.

The adaptability of the wage-payment plan to the cost system should also be kept in mind, otherwise, a system might be selected which would involve a great deal of unnecessary detail work in the cost department. The selection of a wage-payment plan that does not dovetail into the cost system involves so much detail and resulting expense that it seriously detracts from the value of the system itself.

Time as a Basis for Wage-Incentive System

Most people when they think of a wage-incentive plan, think of piece-work. As a matter of fact, piece-work is probably the oldest method of wage incentive, and, therefore, much better known than any other. Consequently, it is not unnatural for a person to connect an incentive system with piece-work.

In the past years, there have, however, been a number of wage-incentive systems based on the time element rather than on the money element. The basis of time has a great many advantages over the piece-work system, principally due to the fact that it lends itself better to control. Planning is always done on the basis of time, therefore the time element is very necessary in order to schedule production through the plant, and it cannot be done intelligently with a piece-work system. Of course, two systems might be carried at the same time, the one based on time for planning and control, and the other based on money value for wage payment. This, however, leads to complications, and, therefore, unnecessary expenditures of time and money.

The rates on any incentive system, regardless of whether it is on piece-work or a time basis, should be guaranteed to the operator, not for a period of three months or a year, but indefinitely, thereby doing away with the possibility of rate-cutting which has been so disastrous to piece-work plans in years gone by. Where the rates are not guaranteed, and the employer is at liberty to go into the plant at any time and slash rates simply because he thinks the operator is making too much money, the operators show a tendency to slow up production to a certain amount of earnings a day, with the idea that if they do not go above a certain wage level, the employer will not cut the rate. This is entirely contrary to the idea of an incentive system which is inaugurated for the purpose of increasing production and not curtailing it. When rates are constantly cut and adjusted, production is certainly curtailed, and with constant loss in production, increase in the cost is a result. It is when rates are scientifically set upon time study and guaranteed, and the operator made to feel that his rate will not be cut, regardless of earnings, that the real benefit of the incentive plan is felt.

Plants that have been operating piece-work systems with guaranteed rates, have found in the last few years that the practice has been very costly. This is due to the fact that from 1915 to 1921 labor rates were constantly on the increase, making it necessary to increase piece-work rates correspondingly. Then the guarantee kept these rates at the same high figures when wages generally were lowered. Obviously it was impossible to decrease these rates, though so high as to be unfair to the employer because the piece-work rates themselves had been guaranteed against cuts, and a change of rates could not be made without violating the guaranteeing contract.

Another objection to the piece-work plan is found in the fact that when all rates are set on a money basis and these rates are scattered through the various plant records a decrease or increase in piece rates involves changing every record in the plant that has anything to do with the rates themselves.

Also, due in a great measure to abuse of piece-work systems by ignorant and unscrupulous employers, piece-work has come into a great deal of disrepute with workmen, and particularly with the labor unions.

These are some of the reasons why the piece-work system is undesirable. Some of the best wage systems devised in the past few years are on a time basis, and are not open to any of these objections. Where the time element is used to base rates, a constant factor is being employed which does not change with the periods of prosperity and depression. Once a rate is set on a time basis, it can be safely guaranteed for the life time of the job, unless there is some change made in the actual work involved in the operation itself. In any case where a change is made in the operation, the employer is privileged to re-study the operation under the new method of doing the work and then, if necessary, set up a new time standard.

The 100 Per Cent Premium Plan

Chief among these time-basis systems, is the 100 per cent premium plan, and considering all the systems based on the time element from the standpoint of the six requisites of a wage-payment plan, it has advantages over any other system yet devised. The operation of the plan is explained below.

Under some plans of premium, the employee is given 50 per cent of the time saved. In others, he is given 75 per cent. But, under the 100 per cent premium plan, he is given all that he saves. This may seem to be unduly favorable to the operator. Why give him all the savings which he makes instead of only 50 per cent as under some plans? This can be answered by saying that in the setting of the rate per piece, based on the operation itself, the amount of earnings which the operator is likely to receive, is calculated before the rate is set.

If it is expected, with a certain amount of production, that the operator will receive 25 per cent above his day rate as a premium, the rate is set under the 100 per cent premium plan, at 25 per cent above the standard time taken. Or, in other words, if the standard time for the operation is one minute, the time allowed the operator is 1.25. Under the 50 per cent plan, or where the operator receives 50 per cent of his savings over standard, it is necessary for the rate to be set at 1.50

to permit the operator to make 25 per cent at a given production. The same variation of rate holds true with the 75 per cent plan. As a matter of fact, when the costs per piece on different volumes of production are figured out, it is found that the 100 per cent premium plan produces a lower cost than any other system outside of piece-work.

The 100 per cent premium plan has the advantage

RITTER DENTAL MANUFACTURING CO. [illegible]
Daily Labor Report
Date [illegible]

Employee's No.	Part No.	Oper. No.	No. Pieces	Accumulated Time	[illegible]	Time Allowed	Time [illegible]	Premium Earned	Time Lost	Part No.	Oper. No.	No. Pcs.	Accumulated Time	[illegible]	[illegible]	[illegible]	[illegible]	Remarks
			Premium Record							Day Work Record								
6001																[illegible]	[illegible]	
6002	P-109G5	8355	81	0.25	3.75	5.06	4.00	1.06										
6002	P-873	93	196		3.40	4.73	3.40	1.43										
6002	P-897	93	Unf.		0.65													
6003	P-873	80	198	0.35	0.70	1.71	1.05	0.66										
6003	P-873	85	198		1.15	1.98	1.15	0.83										
6003	P-897	80														2[illegible]	[illegible]	
6003	P-897	80	181		0.80	1.17	0.80	0.37										
6003	P-873	115	200		0.40	0.43	0.40	0.03										
6003																2[illegible]	0.80	
6003	P-873	120	200		0.60	0.66	0.60	0.06										
6003	P-873	125	200		1.40	2.16	1.40	0.76										
6003	P-897	20	Unf.		1.50													
6004	P-102G10	25	Unf.		7.80													
6005	P-67															2[illegible]	2.20	
6005	P-109G5	8360	82		3.75	4.98	3.75	1.23										
6005	P-2659	14	150		0.95	1.07	0.95	0.12										
6005	P-109G5	8365														[illegible]	0.45	
6005	P-109G5	8365	Unf.		0.45													
6007	P-664	8185	123	1.65	1.80	4.61	3.45	1.16										
6007	P-663															2[illegible]	0.55	
6007	P-663	8285	117		0.75	1.22	0.75	0.47										
6007	P-664	8190	122		0.80	1.28	0.80	0.48										
6007	P-664	8195														255	0.35	
6007	P-664	8195	121		1.25	2.01	1.25	0.76										
6007	P-663	8290	118		1.20	1.96	1.20	0.76										
6007	P-663	664														235	1.40	
6010	P-2316	15	317	3.35	0.40	3.80	3.75	0.05										
6010	P-2316	20	317		0.65	1.05	0.65	0.40										
6010	P-2607	11	182		6.75	6.97	6.75	0.22										
Total				5.60	40.90	46.85	36.10	10.85									[illegible]	Total Productive Hours in Dept. 54.6[illegible]

Percentage of Hours on premium 75 Percentage of Hours on Day Work Percentage of Hours on Non-productive Labor. . . 25

FIG. 3 DAILY LABOR REPORT

over the partial payment plans, that it is easier to "sell" to the operator. Obviously he is far more likely to enthuse over a proposition under which he is to receive all the benefits of his efforts, than if he were only to receive a portion of them. Operators naturally dislike the idea of dividing their savings with any one after they have worked hard to gain them, and, therefore, become disgruntled with the partial payment system and do not put forth their best efforts.

Under the 100 per cent premium plan, as with all other time-basis plans, the employee is engaged at so much per hour as his day rate, and this amount is paid him, regardless of whether he makes premium or does not, and he is also paid everything he saves at his hourly rate. For instance, if an operator is allowed 2 min. per piece, he is allowed 180 min. or 8 hr. in which to finish 240 of those pieces. If he completes the work in 6 hr., he has saved 2 hr. which is paid him at the hourly rate. This, if 60 cents per hr. is the rate, would be $1.20 premium earnings besides the $3.60 he made at his regular rate during the [illegible] actual time [illegible].

It can be readily [illegible] that [illegible] as an operator makes premium [illegible] cost on [illegible] operation remains constant. The [illegible] per piece [illegible] decrease regardless of whether the [illegible] makes [illegible] per cent or 100 per cent of his hourly rate because he is paid everything he saves, and is, therefore, paid for the time allowed to do the work. The only time where an operation cost will vary is when the operator fails to reach standard, in which case labor cost increases in proportion to the amount of time he loses on the operation. This is the control feature, mentioned earlier when speaking of the selection of a wage-incentive plan. Under this system, the only operations of direct labor which have to be watched closely are those on which time is lost.

Standard Costs

This system, therefore, readily lends itself to the plan of standard costs. The actual cost of production is determined and made standard. Obviously there is a great waste of effort in constantly compiling costs which never change except in cases of loss, when losses are not very heavy, which as may be suspected, is the case under a control of this kind.

In setting up standard costs of labor under this system, the first step is to determine the day rate paid to operators on a given type of work. When this has been determined, the cost sheets are gone through and the time allowed on each operation is extended according to the day rate which is to be paid on that class of work. For instance, if the first operation is "grinding," and the time allowed is $1\frac{1}{2}$ min. and the rate per hour paid on that class of work is 60 cents, the rate paid is really 1 cent per min. or $1\frac{1}{2}$ cents for the $1\frac{1}{2}$ min. operation. If, on the next operation, the time allowed is 0.75 min., and the rate per hr. is 48 cents, the cost for the operation is 0.36 cents. The various operations on the part are then calculated and totaled, giving the standard labor cost for the part.

Fig. 3, "Daily Labor Report" shows the manner in which a daily control of direct labor is obtained. A report of this kind is made out for each productive department by the time clerk, showing the employee's number, the part number worked on, the operation number, time taken on operation, and the amount of premium earned or lost. A copy of this report goes to the foreman by 9 o'clock of the day following the completion of the job, and this immediately gives him a check up on every operator in his department. A copy of the report also comes to the cost department where the money value of the time lost is calculated. The amount of money lost through failure on the part of operators to make premium, is charged into a "Labor Variations Account" which is later disposed of through cost of sales.

In articles to follow, it will be pointed out how standard direct labor cost is combined with the standard material and overhead costs, to arrive at a complete standard cost. It will also be pointed out how the variations from these standards are disposed of through monthly statements of cost of sales and through profit and loss.

Use of Industrial Trucks and Tractors

Class Number
658.281 Industrial Trucks

EVEN plants which are equipped with industrial tracks and small cars need also, in general, other kinds of transportation because the tracks cannot extend to all points in the plant. In such cases the small industrial truck and the power tractor are useful adjuncts to the system. The former carries materials of all kinds, patterns, parts going into the plant product, and even completed units of product, if they are small and easily handled. Repair gangs often use these trucks to carry tools and supplies which have to be taken to parts of the plant where other means of transportation do not extend, or in cases where jobs have to be done in a hurry and the other systems are not at once available. Such trucks are low in first cost, economical to run, will stand up well under hard service and severe shocks, and can be operated in very small spaces, around sharp turns, and through narrow passageways.

Tractor Replaces Horses

Where power tractors are used in some parts of the plant, they can be made to co-operate very well with the industrial track system. One of the disadvantages of a small industrial railroad system running through the departments of a factory is that men or horses have to be secured as motive power for the small but heavy cars. The entrance of a horse or mule and the drawing away of a train is slow and interrupts work. The necessity of keeping a horse is an additional nuisance, for most plants are not well equipped to care for horses.

A railroad tractor, however, built for yard use, will hook onto the front of an industrial train and take the place of animal power. The fact that the gasoline-driven tractor is not equipped with railroad wheels does not prove an objection against it, as is shown by the picture, Fig. 1, of a tractor in use as a locomotive for industrial cars.

The tractor straddles the track and the wheels run upon the ground, while the wheels of the little industrial cars run smoothly upon the tracks intended for them. A powerful tractor finds no difficulty in crossing tracks or running over cross-

FIG. 1 A TRACTOR USED AS A LOCOMOTIVE

ings, switches, and Y's, even when approaching the rails at an angle, for a yard tractor can go practically anywhere that a mule needs to go—in fact, the shop term for a yard tractor is a "gas mule" or "electric mule."

The "Tell-Tale" Control Board

A Device of Visualized Management

By CHESTER B. LORD

A PRECEDING article gave the idea of a plan of Management Control based upon visualizing exceptions to regular routine and procedure. The six rules covering this visualization were also given; and it is now in order to show the device or mechanism by which visualization is secured and each item selectively emphasized so that it may receive attention according to its needs.

The device has been named the "Tell-Tale" and its purpose is to show the condition of any item at any time and to answer all questions regarding its progress or lack of progress except the "why."

In general terms, it is a simple, self-contained, kinetic chart capable of indicating simultaneously any or all factors of industrial operation no matter how diverse, in terms of a common denominator, and of indicating selective responsibility in the measure that the condition of any item demands.

A New Combination

There is nothing new in its components other than what is called "a new and useful combination," that makes possible the use of the exceptional principle in management to any desired degree. It is in no sense a tickler or record chart, for exceptional management has no need of any save its master records and a periodic report.

The Tell-Tale is made of a special wire screen with a mesh corresponding to typewriter spacing, and may be made in any length or width. In practice 24 is found the most convenient, both for its visibility at long range and because in mass control such as material, and at times fabrication, it can be divided horizontally into two, or even three charts, thus doubling or tripling the items shown. Used 24 in. wide it gives 40 double indications to the linear foot; and when divided 40 to the square foot, and as an 8 x 11 sheet double spaced gives but 30 items as a maximum, it will be seen that it compares favorably with any other method of graphic presentation.

By double indication is meant the use of two indicators for the same item where necessary—one white, the other black. This differentiation is of value when we wish to indicate rough and finished on the material chart, condition and time on the sales order, or cumulative and current on the distribution Tell-Tale; used thus they give not only a relative visualization but a deductive perspective that would be impossible were the factors not concentrated.

The indicators are celluloid buttons attached to a string of a corresponding color and provided with means for attaching to the chart in any desired position; and inasmuch as the string leads from the indicator to the symbol and acts as an immediate guide for the eye, it is unnecessary to use care in placing the indicators accurately under the symbols, and as definite quantities are not considered except between planned limits. The same thing is true of the vertical height at which they are placed; accidental indication is impossible as there is no dead area; an indicator "let go" demands attention or verification.

Class Number
658(004) Management Control Board

The Tell-Tale proper is divided into four horizontal colored zones. If the working field is 20 in. wide these are 8, 6, $3\frac{1}{2}$, and $2\frac{1}{2}$ in. wide respectively, moving from the bottom upward. These zones in the same order are designated as vital, emergency, essential and normal; whatever factors are assigned to them always bear this relative relationship. To some extent this relationship may vary as to the emergency and essential zones, but the normal and vital zones are constant and any factors assigned to them must bear a comparative relationship to those above and below. These four zones again moving from the bottom upward, are painted red, yellow, blue, and green respectively, so that their color intensity and zone width both decrease as conditions approach normal. All four colors are the most vivid procurable, and naturally an 8 in. bright red zone attracts the eye first, and after that the 6 in. yellow one, while the $3\frac{1}{2}$ in. blue and the $2\frac{1}{2}$ in. green have much less power to arouse attention. The red and yellow zones indicate dangerous and near dangerous conditions; the blue and green are routine zones indicating normal or near normal conditions.

The Symbol Zone

Above the indicating zones is the symbol zone in which names, part numbers, or other factors are indicated either upon a strip of adding machine paper or individual card holders as circumstances warrant. For listing material where items change but seldom or not at all, it is easier to write them continuously on a long strip allowing the typewriter to do the spacing, but where items vary or are few in number card holders are used. The space over the top of this symbol zone is used for indicating conditions that vary from those below, such as excess, inactive, shipped, operate, etc., and as this indication causes the string to be led upward from its source instead of downward, it is an indication that differentiates itself entirely from the others and prevents accidental indication.

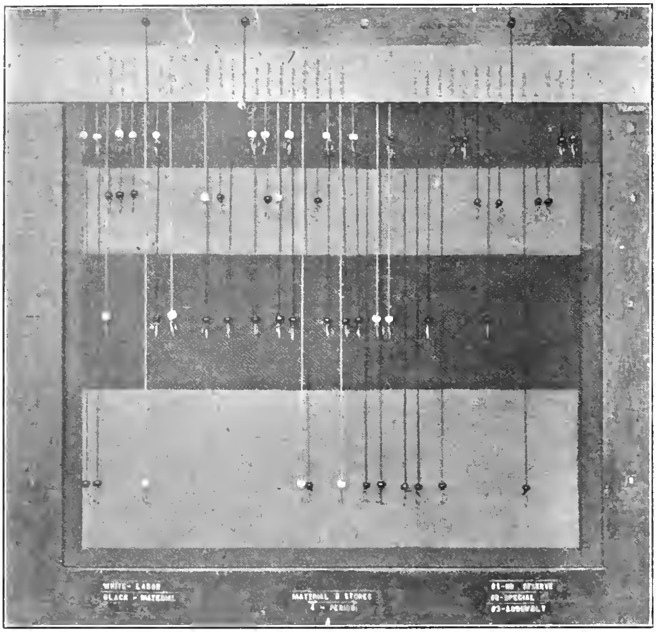


FIG. 3 (a) THE MATERIAL AND STORES TELL-TALE

From this brief description, it will be seen that the common denominator which is visualized on the Tell-Tale is condition. Everything in industrial operation regardless of its nature can be classified into one of the four conditions; normal, essential, emergency, and vital. The two central ones, essential and emergency, may be looked upon as merely different degrees of the same thing, but normal and vital represent sharply differentiated extremes. As a matter of fact in some instances it is only necessary to plan for normal and vital stages, the others adjust themselves.

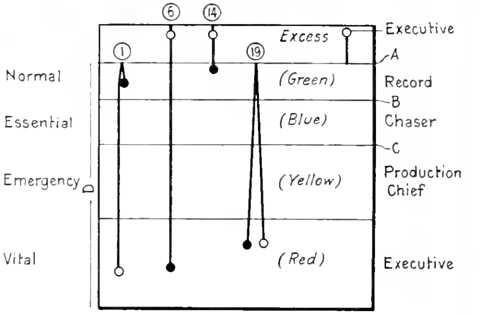
The application of the Tell-Tale not only uses planning but demands it, for each item must be started right with its probabilities and liberties fully charted, and so long as it is within the bounds set, it receives but routine or essential attention. If it goes outside those bounds it receives the attention of the head of the department or the executive head; and as the Tell-Tale may not be posted by those who are guided or checked by it, its accuracy of operation is assured; and as "it notes the condition of all items at all times" its arrival at vital is gradual and foreseen, with all preventive measures taken beforehand, instead of remedies applied afterward.

Because of its universality, it is difficult to discuss the application of the Tell-Tale in general terms because that which is true in one application is not true in another, but none of the six rules laid down are violated in any way and the test of universality lies in the widely diverse meaning of the indicators in different applications. If we place the white one in the blue or essential zone, and the black one for the same item in the red or vital zone, we secure the readings shown in Table 1.

The double indication and significance gives the answer in terms clear to anyone and points the next step, and with a natural knowledge of the condition that gave rise to the indications we are able to make deductions as to the "why"; two factors of an equation give the third, which is control; but one does not necessarily give the second, which is system.

The Material and Stores Tell-Tale

Figs. 3 (a) and 3 (b) show in the first a halftone and in the second a diagram of a Tell-Tale to visualize Material Control. This is the first and most important Tell-Tale to be installed; it may be used independently or in conjunction with others but in any case it is dominant. If used alone it forces changes in the systems contributory to itself by demonstrating the soundness of rule 2 that: "Time being the basis of manufacture, all factors to be intelligible and comparable must be presented in terms of time." Inasmuch as posting items upon the Tell-Tale has changed them from "terms



Information Indicated Directly:
Rough Stores (Black Indicator)
Finished Stores (White Indicator)
A = Maximum Allowance
B = Order Point. C = Express Point.
Minimum Stores. D = Time.
Excess. Signature Bank.
Exceptions. Labor Required.
Attention. Assemblies.
Periods. Selective
Error. Responsibility.

Information Indicated Indirectly:
Efficiency of Purchasing Department.
Efficiency of Material Department.
Efficiency of Production Department.
Reducing Point.
Increasing Point.

1 *Exception, No Reserve.*
6 *Low Finished Excess Rough Stock, Fabrication Telltale Shows no Tools. Extra Lot Ordered.*
14 *Engineering Change. Not Usable White Indicator at Attention Point.*
19 *Material Overdue (See 19 Purchase Telltale)*
To Reduce Schedule: Cancel at Green.
To Increase Schedule: Order New Quantity at Red.

FIG. 3 (b) FUNCTIONS OF THE MATERIAL TELL-TALE

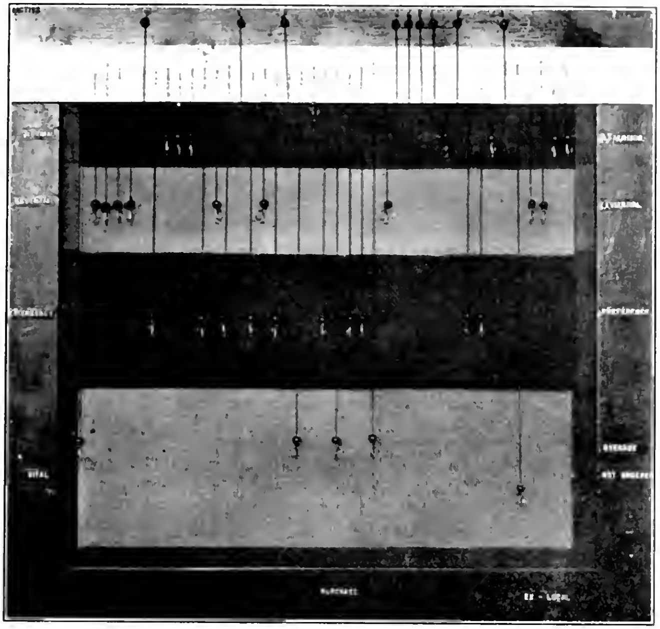


FIG. 4 (a) THE PURCHASE TELL TALE

of quantity based upon time," into "terms of time based upon quantity" we soon see the desirability of fabricating in terms of time also, so that all factors of production may have a common denominator instead of half of them following repetitive fabrication methods, and the other half following intermittent fabrication methods.

Eventually it shows that the purchase department is out of step and a Tell-Tale co-ordinated with the Material Tell-Tale is installed in that department, and then

TABLE 1. READINGS FROM THE TELL TALE

APPLICATION	COLOR	INDICATION
Material	White	Finished material at order point.
	Black	Rough material exhausted.
Fabrication	White	Tools being worked upon.
	Black	Work not started when promised.
Purchase	White	Represents material purchased ready for use.
	Black	Material not ordered.
Equipment	White	Machine utilized 75 per cent of the time
	Black	Machine is unusable because of needed repairs.
Sales order	White	60 per cent of promised time has elapsed
	Black	Awaiting sales information.
Distribution	White	Budget for last period well within limits.
	Black	Budget for year to date over maximum limit.
Despatch Board	White	Start this item at your convenience
	Black	Plates for this job are ready.
Clinical Log	White	Temperature of patient is slightly above normal.
	Black	Condition of patient is critical.

as far as production control is concerned we have checks, which are "obligatory, recurrent, and unevadable." Any and all Tell-Tales used for production control are synchronized with the material chart and their posting becomes largely a matter of routine, because we are controlling variations at the source instead of catching them as they come to the surface.

The material Tell-Tale directs the activities, and visualizes the results secured by the production department; and as we have taken the guess-work out of material as far as the shop is concerned, by rule 1, this direction is a simple task based upon the records.

Fig. 3 (b) shows in detail the functions of the Material Tell-Tale and the small figures in the circles correspond to the items on 3 (a) counting from the left; those items showing faintly (or in different type) as 1 are exceptions and are referred to at the bottom of 3 (a).

The Purchase Tell-Tale is the

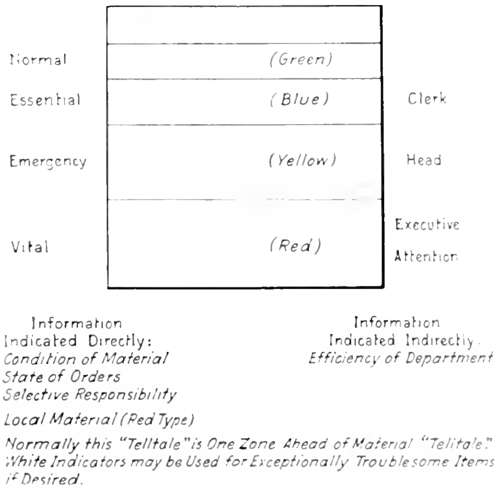


FIG. 4 (b) FUNCTIONS OF THE PURCHASE TELL TALE

simplest of all installations for here we deal only with material and but one indicator is necessary. A white one may be used to indicate either local purchases or material that is purchased ready to use, the latter co-ordinating it with the material chart.

This Tell-Tale is in effect a despatch board operated by the production department; it anticipates the condition of the Material Tell-Tale. It is, however, definitely directive and not a tickler. In conjunction

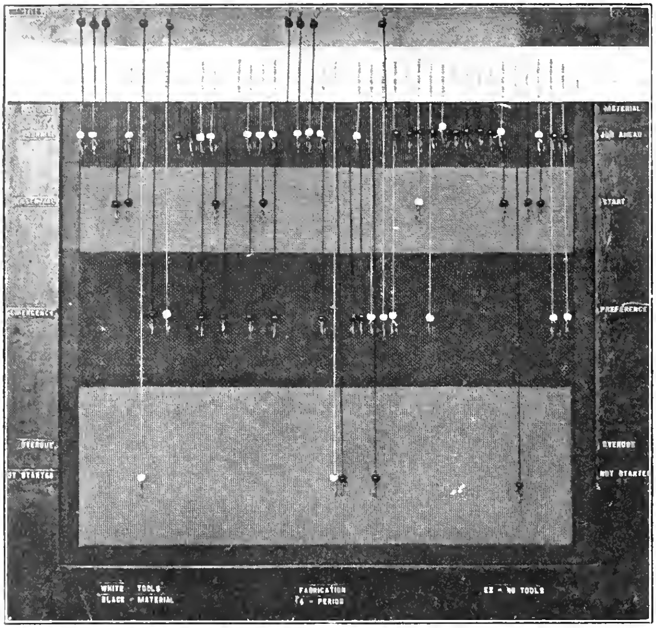


FIG. 5 (a) THE FABRICATION TELL-TALE

with the Material Tell-Tale, it also acts as a measure of management and fixes both the relative and actual efficiencies of the purchase and production departments. By relative we mean those items that go to red but may or may not actually curtail or delay production; by actual we mean those that do. The latter is a by-product of the periodic report as to why items are in the red.

Fabrication Tell-Tale

The Fabrication Tell-Tale is similar to the Material Tell-Tale and it may be either in terms of fabricating time or like the Purchase it may act as a despatch board and be synchronized with the Material Tell-Tale anticipating it by different periods dependent upon the class of material. It is used in any department of sufficient size to warrant its use; some of the factors changing, of course, with different departments. In the machine shop the white indicator represents tools, and the black one material to be furnished *to* it; in the foundry the white represents flasks and cores, and the black material to be furnished *by* it. In the forge shop they represent dies and material either furnished *by* or *for* it.

The Tell-Tale eliminates almost entirely the necessity for conversation, schedule sheets, and correspondence between the production department and the shop. The chaser moves the black indicator to job ahead when both tools and material are ready, or moves it to start, which makes it optional with the foreman whether to start it or not. If, however, he moves it to preference instead of to start it becomes obligatory and the foreman must give a *starting* promise. If that promise is not lived up to the chaser simply moves the indicator to red when it becomes a matter between the foreman and the shop executive whoever he may be, but as a matter of fact unless there is a very good reason he will get it started before the boss gets around to him. The valuable thing is that there has been no unnecessary conversation and it is understood that the chaser has no option but to move the indicator to red and it is not resented. Also the shop executive has been notified at the *start* of its delay. It is obvious that the same Tell-Tale may indicate for any operation where functional management is employed, or for the item only where the foreman is held responsible, and in any case it represents the limiting operation with which we are concerned.

Sales Order Tell-Tale

The Tell-Tale shown in Figs. 6 (a) and 6 (b) is, from the point of view of our discourse, a special application, for we are dealing with repetitive fabrication and this shows sales orders for a small or specialty shop.

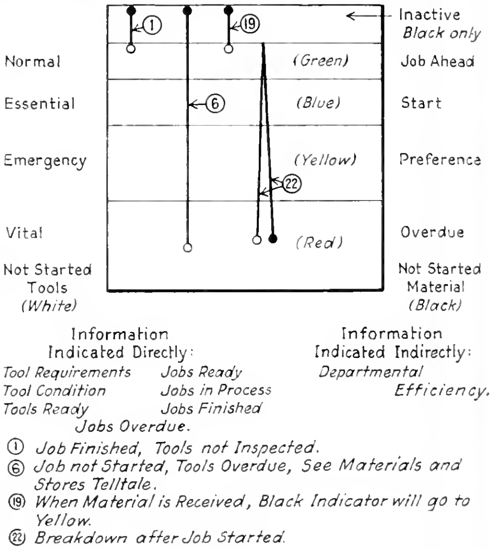


FIG. 5 (b) FUNCTIONS OF THE FABRICATION TELL-TALE

Its indications may be in terms of machines, dollars, or in any other desired unit. The direct information given concerns capacities and time. Indirectly it gives

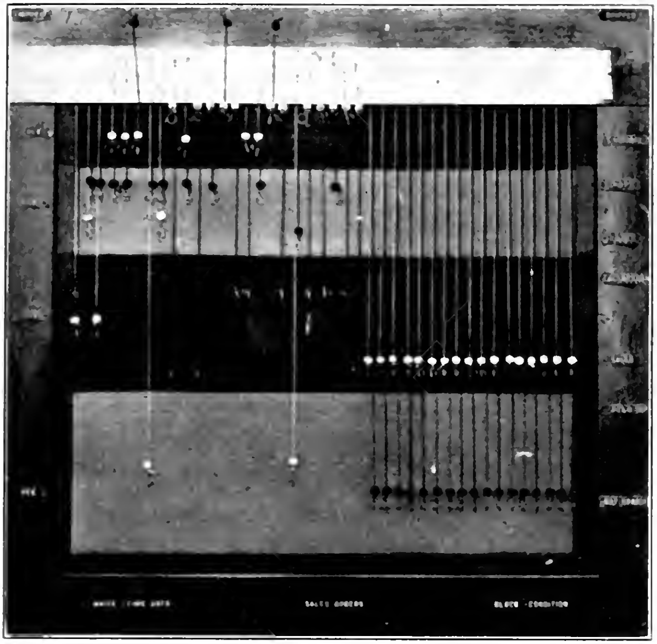


FIG. 6 (a). THE SALES ORDER TELL-TALE

the reason for delay. The heads of departments are concerned with those items which are indicated opposite their department by the black indicators, and the chief executive, according to the exception principle is concerned only with those which appear in the red zone. From this Tell-Tale may be figured the efficiency of the sales and engineering departments.

Once budgets are established it is essential that they be lived up to. Herein is another application of the Tell-Tale and one which is directly in line with the definition of visualization: "The presentation of any number of related facts in correlative perspective, correctly evaluated and selectively emphasized." Figs. 7 (a) and 7 (b) show the Distribution Tell-Tale in which the principle of visualization and indication of exceptions finds its fullest development.

A glance at Fig. 7 (b) shows that the following factors and accounts of management control are shown:

Sales	Administrative Cost
Billing	Appropriations
Purchases	Taxes
Inventory to Sales	Shop Overhead
Balance of Stores	Compensation
In Process	Scrap
Inventory	Machine Repairs
Labor Cost	Expense Tools
Material Cost	Labor Turnover
Sales Cost	Labor Supply
Development Cost	Labor Morale
Service Cost	Buildings and Grounds
Advertising Cost	Light, Heat, Power and Water

A moment's consideration shows that some of these items become critical due to increase, such as purchases and labor costs, others become critical with decrease, such as sales and billing. Further, some of the factors such as labor morale are intangible and perhaps controversial, but at least they are a matter of opinion and the visualization of this opinion is useful to the executive. All these factors are shown side by side on the same Tell-Tale "properly evaluated and selectively emphasized," not only as to current results, but cumulatively or comparatively for any desired time. Any item may be set forth under its proper title or symbol, or under a key, if there is any reason to keep the information partially confidential.

In connection with all these Tell-Tales, it should be emphasized that movement of the indicators denotes condition. Placing an indicator in the red zone shows that the corresponding item demands executive attention, but does not necessarily imply criticism of any subordinate. It does, however, indicate that at this point or in this condition the executive has predetermined that the matter requires his attention, either as a precaution or necessity.

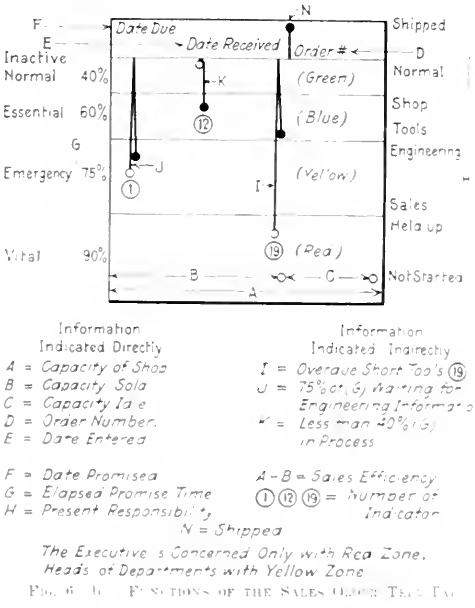


FIG. 6 (b). FUNCTIONS OF THE SALES ORDER TELL-TALE

To those who hold the key, the Distribution Tell-Tale is a measurement of management effectiveness, but no

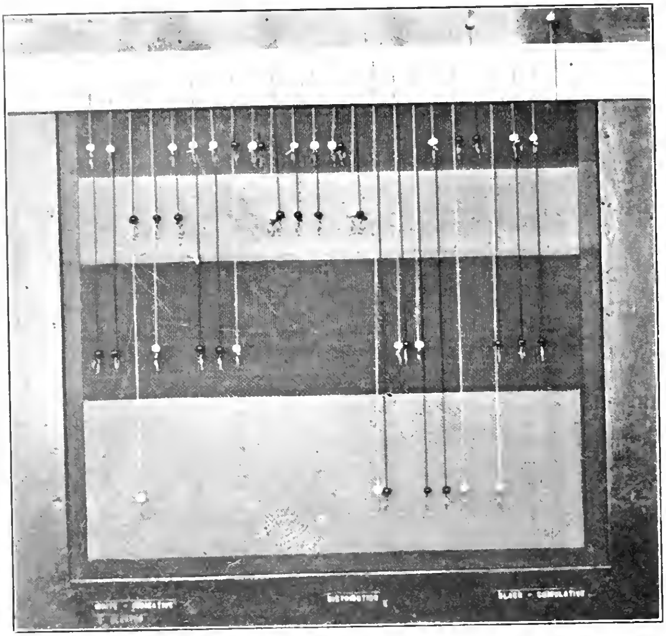


FIG. 7 (a) THE DISTRIBUTION TELL TALE

one department can point to the items of another, which demand executive attention and say—"Here you have failed"—for the Tell-Tale does not indicate failure, but the time for action.

A word may be of interest as to the amount of labor involved in operating a set of Tell-Tales for an industrial plant having in mind that 100 per cent management requires the visualization of 100 per cent of factors 100 per cent of the time, as against present practice of possibly 80 per cent, 80 per cent of the time.

Visualized management is a simplification and consequently requires less directive and clerical work with no extra labor for posting Tell-Tales. It eliminates the productive department as a dominant department and substitutes an operating department consisting of reduced material, process and productive departments under the productive head, so that his responsibility is increased and all the factors of production are at his disposal.

If it is desired to add a co-ordinating department, it has been demonstrated that two girls and a messenger boy can co-ordinate a plant of 5000 people visualizing all the items other than those appearing upon the Fabrication Tell-Tales and notifying on a proper form each executive and department head of items that need their attention, and acting as a checking, information, and notification bureau, which is "co-ordination without laps, gaps, or arbitration."

The point is that the head of the department or the executive attends only to the things indicated, or in the case of his absence, attention is given by his chief aid. Therefore, the tell-tale chart is a measure of management for a particular office or department, or in the case of the chief executive, of industrial operation as a whole. If the principal control boards are arranged in a chart room, a glance at the several tell-tales conveys more meaning to a board of directors than any number of reports, outside of the financial statement. Control is still further simplified in that there are no schedules except permanent ones, no orders except the moving of an indicator, and no irritation. Yet everyone, from clerk to manager, knows when any slip has been made, and there is no possibility of "squealing" or evasion of responsibility. Still further, co-operation is secured, making clear our definition of "the perfect performance of one's own part of a given task." No greater help can be given in industrial operation than this, substituting service from below for arbitrary decisions from above.

Another article will tell in detail how each one of the tell-tales is posted, and the way in which the indications bring executive action.

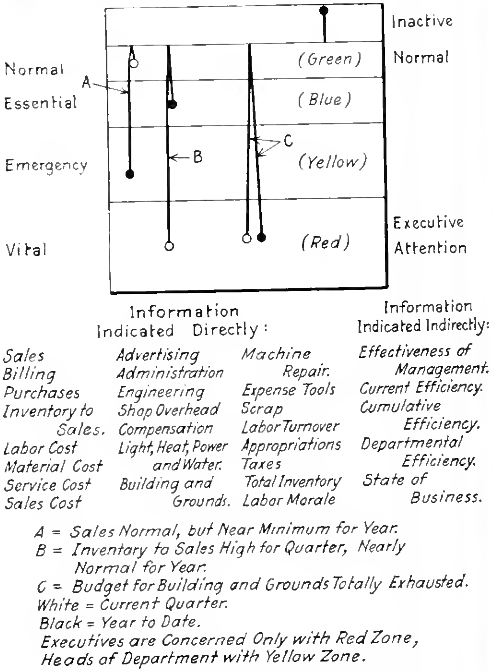


FIG. 7 (b) FUNCTIONS OF THE DISTRIBUTION TELL-TALE

How Much Money Can Your Department Collect by the First of Next Month?

A Question in Credit Control

By J. W. HALLMAN

Credit Manager, Sun Oil Company

Class Number
658.882 Credit Department
658.88 Collections

IN any business, large or small, it is necessary at times to secure comparatively large cash sums to meet some approaching obligation. Naturally, the readiest means at hand for the purpose is to collect money owed to the firm by customers who buy on a credit basis. Proper planning will put this method into such shape that it can be employed on short notice at any time with successful results, and without impairing the friendly relations between the concern and its customers.

In the earlier years of our business, when we were not working by budget and our credit department was in its formative stage, requests for large sums of money were often quite disconcerting to me, since I thought we were already doing our best in collecting accounts. I determined to find a way to respond to the requests without being so severely "jarred," and, in fact, to anticipate them. I watched our accounts payable, especially for any extraordinarily large purchases of supplies, and chased our collections hard enough to keep the bank balance of sufficient size to meet the bills. Of course, incidentally, that meant a good selection of credit risks and satisfactory collection methods.

Accounts Receivable, Current	$
Accounts Receivable, 30 days overdue	
Accounts Receivable, 60 days overdue or more not including attorney and uncollectible accounts	
Accounts Receivable, In attorney's hands	
Accounts Receivable, Uncollectible	
Accounts Receivable, TOTAL	
Collections	
Net Sales	
Value of orders held up	
Value of orders canceled	

FIG. 1 MONTHLY REPORT FROM BRANCH OFFICE

However, I was not quite satisfied with merely that. Our books told us the amount of sales and receivables. I knew the many factors that caused these accounts to vary, and that collections were sometimes good and other times bad. But I wanted something tangible before me at all times for constant reference and comparison. Here is the system we developed and now follow, in addition to the lists and records usually kept in modern credit departments showing customers' names, amounts due, past due accounts, and similar items.

First, I keep a list of our largest and most important accounts, as well as one of troublesome accounts, before me on my desk. I know just what is happening on this class of accounts from day to day. Usual routine work is kept up constantly on all accounts, of course. An auditor, several years ago, recommended the discontinuance of these lists to reduce expense, but when the management learned their real administrative value by experimentation without them, the order for their continuance was promptly given.

Second, we have a monthly report coming in from all branches giving information as shown in Fig. 1. We accumulate the results of these branch reports, on a report form similar to Fig. 2. From this sheet we chart our results month by month and year by year, as illustrated in Fig. 3.

In administering the work of the credit department, I watch these various local reports, and the local conditions that cause fluctuations in accounts. I also keep my eye on the summarized sheet for results as a whole, and on trade reports of general conditions that affect the entire business. The chart enables me to visualize our progress and the trend of the various accounts by months, seasons, and years.

So when our treasurer called me into his office early in July before June figures were in, and said: "How much money can you collect by August 1?" it was not a very difficult matter to consult these records and supply him with a correct estimate of the actual cash we could give him by the end of the month. I mean

BRANCH ACCOUNTS FOR 192

Branch	Current	30 Days	60 Days and Over	Attorney	Uncollectible	Total Accounts Receivable	Collections	Sales	Orders Held	Orders Canceled
Totals	$									

FIG. 2 MONTHLY SUMMARY FORM FOR ASSEMBLING BRANCH OFFICE REPORTS

cash in the bank to draw checks against, not merely trade acceptances or notes. It was simply a matter of sizing up previous months' business, observing the trend of sales and receivables, noting the seasonal swing of our business, taking into account conditions in various sections of the country including prices on our products, and arriving at an approximation of what our collections with ordinary routine efforts should produce. But as I knew the treasurer was anxious that we make the amount just as large as possible, I added, let us say, a quarter million dollars to my first figures, depending upon what I call a "shock-absorbing" account to take us over the top. We made good by a safe margin on July 30—with one day left on our time limit.

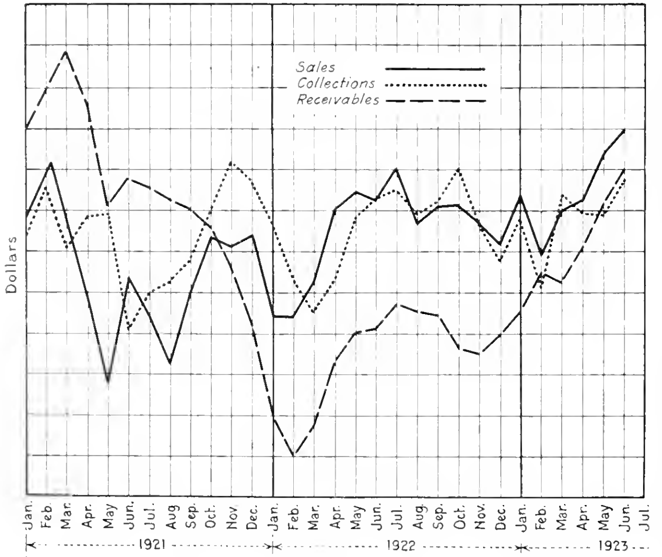


FIG. 3 CHART SHOWING ASSEMBLED BRANCH OFFICE REPORTS

Perhaps the easiest way to explain a "shock-absorbing" account is by illustration. Suppose, in granting credit, a credit manager handled a $24,000,000 a year business on regular terms of 30 days net, less 1 per cent discount for cash in 10 days. This would require him to collect $2,000,000 monthly. If $500,000 is discounted, and $1,000,000 paid at the end of the net period each month, the remaining $500,000 could be paid at the end of 50 days, and he could still maintain his $2,000,000 per month collections (except for the first month). But, of this delinquent 25 per cent, 15 per cent will probably pay in 35 to 45 days, while among the remaining 10 per cent are those who will take as long as they can, those who require adjustments or extensions, those whose accounts are paid only in part through composition settlements, receiverships, and bankruptcies, and those entirely lost as bad accounts.

He has at his disposal, then, this last $500,000 as a "shock-absorbing" account. Now if he is a good manager he will, on second sale to the chief offenders, revise terms to whatever extent may be necessary to get his money within the time he wants it, even to the extent of cash terms. This, incidentally, sometimes requires a little salesmanship for accomplishment. He will thus be constantly eliminating from his "shock-absorbing" accounts by corrective measures those offenders who are delinquent only because of indifference, carelessness, selfishness, unfairness or the like, and keeping in reserve as large a portion as possible of this account to assist worthy debtors in times of emergency and misfortune. Occasionally, when his own business is pressed for funds, he can, if he handles this account properly, put a little extra pressure on the collection of accounts from such customers and secure the required funds without much difficulty.

The "shock-absorbing" account is ordinarily referred to as the "delinquent, or overdue collections," account. Such is the usual point of view, and the account usually *is* just that; but if my point of view is taken, and the account is handled intelligently, it can be made a real servant of the customer, the sales department and the management of a business. It can truly be made just what I have styled it—a "shock-absorbing" account—that helps embarrassed customers over difficult places, that helps the salesman meet unusual conditions, and that produces emergency funds for the management when needed.

We have in the past fought shy of trade acceptances, chiefly because a certain class of trade (usually that most eager to "close" their accounts by acceptance) has greatly abused this instrument, wanting to give trade acceptances in settlement of overdue accounts and then at the same time secure additional shipments. I really have a very great liking for the trade acceptance when properly used. I believe it is destined to become the greatest stabilizer of credits the business of this country has ever known. It is a great boon to the credit department that properly uses it; its effect can be very harmful if misused. Where trade acceptances are generally used, in the proper way, a question like our treasurer's could also readily be answered. It is an easy matter by this method of collecting to know from day to day what receipts from customers will be.

The cost of operating a credit and collection system like this is low. There is very little work attached to it, as anyone can see. Its effectiveness and inexpensiveness lie in its simplicity. All the work on these lists and reports at our home office does not consume more than two days of a clerk's time monthly, which is nothing compared to the administrative value of the plan and its result-producing qualities. Time is really saved by the plan because special investigations are unnecessary to determine the condition of credit.

Keeping Track of the Advertising Appropriation

By MONCRIEFF HAMILTON SPEAR

Director of Copy, The John S[illegible]

Class Number
658.9:659.1 Advertising Department. Management
657.524:658 Cost Control

THERE are certain conditions which make detail control and precision exceptionally important in advertising work. And perhaps nowhere in business is the detail more bewildering, and precision more difficult to attain. Market conditions change rapidly, and so the advertising man must work fast. Yet absolute accuracy is essential. A typographical error in a costly page may make the advertiser and his wares a national joke.

Because advertising work is done in the sight of everyone, very small imperfections, which would pass unnoticed in the work of the average executive, bring swift criticisms to the publicity man. And he can seldom answer criticism by showing definite, immediately traceable results, in dollars and cents. His returns may not come for weeks or months after the work is done. Except in the mail-order field, it is not possible to trace the connection between his activity and a silent change in the minds of people he never sees, who may be led by him to the point of purchasing. Almost, perforce, he is judged by his way of working. His power to sell his plans to the financial high command will naturally depend on the respect he has won; and this in turn will be based on what can be seen of his work.

> **In establishing effective control of the financial and technical factors of advertising, the executive must avoid two extremes: allowing himself to be smothered by a mass of detail; or losing his grip by complete disregard of detail.**
>
> **This article, by a specialist who believes that the advertising agent should render genuine service to the executive, outlines a plan whereby the officer in charge of the advertising of a business enterprise may successfully avoid the two extremes.**

It often happens that creative men are weak in dealing with material detail. Every executive of every kind must meet and solve this problem; for if details swamp him he becomes a clerk, while if he neglects them they ruin his plans. To avoid the reproach of the theorist, while controlling the burden of routine, he must build up around himself a structure of systems —of "business habits"—and must learn to work inside it.

Development of Pre-Planning

Certain plans for advertising work are here outlined. Whether they fit the needs of other than advertising men, or even of other advertising men, is perhaps problematical; but they represent a development of the pre-planning idea which many executives have found interesting. Their peculiar advantages will appear as the description proceeds, but it may be said at the start that they have been employed in a "one-man department" without proving unduly burdensome, or involving too much red tape.

First of all the executive responsible for advertising needs a method of keeping track of the daily condition of his appropriation, the funds allowed him. If he overspends he will throw out of balance the financial plans of his house, and the reckoning will be swift and drastic. But it is almost as fatal to his success to find, before his plans are complete, that his funds are nearing their end and that he must sacrifice some essential feature for the sake of keeping within the limit.

Frequently his contracts are made far in advance, and most of his appropriation may be spent before he actually approves a single bill. Tempting side-issues are always appearing through the year, each costing very little, perhaps, and frequently making strong appeal to his judgment, yet a way must be found to avoid straying from the pre-established path through inadvertence.

The simplest plan is to keep an "Appropriation Book," something like the one illustrated in Fig. 1. Details of column arrangement may be altered to fit particular conditions, but the general idea seems widely applicable. The advertising expenditures are recorded in conjunction with a budget, in which expenditures are constantly checked against available balances.

The book may be loose-leaf or bound, large or small; but it should be ruled to show dates, items, possibly order-numbers, and should have at least four money-columns under two separate heads. One of these main heads should be labeled "Estimated" and the other "Actual;" and under each head the columns should be headed "Expenditure" and "Balance." Each month's record may well be started on a fresh page, and the items should be posted monthly to account pages or analysis columns summarizing in accord with the needs of the business—perhaps showing the amounts spent in advertising different products, or in the several territories, or in certain media, or by item purchased, or in some trade or consumer classification peculiar to the business.

Advertising appropriations are usually voted on the basis of some prearranged plan or outline; so much money is to be put into this medium, so much will be spent to advertise that particular product, this territory will receive such a proportion of the total, etc. In other words, the advertising manager works from a budget; and as records are made in his "Expenditures" column, under the "Actual" heading—that is, as bills are passed—he will post the items to the analysis column or account pages. At the head of each will be entered the total allowance; and it is a simple matter to see thus that money goes where it should. There is no purpose in posting estimated expenditures, though as the end of the fiscal year approaches he may from time to time pencil these in if he fears that some feature of his work is getting more than its share of money. Naturally the "Balance" columns will not be posted—they are simply current reminders of leeway.

MONTH .... YEAR ....

DAY	ORDER NO	ITEM	ESTIMATED		ACTUAL	
			EXPENDITURE	BALANCE	EXPENDITURE	BALANCE

FIG. 1 APPROPRIATION RECORD

Probably by now the uses of the book will be evident. At the beginning of the fiscal period the two balances—"Estimated" and "Actual"—will be the same. With the making of contracts, as for space or for printing, the totals involved will be entered in the "Expenditures" column under the head "Estimated," and the proper deductions made from the "Estimated" balance. The latter will then be far below the actual balance; but the money needed to meet the bills on those contracts cannot be considered available for other uses. Through the deduction, assurance is given that it will not be spent twice because of forgetfulness. The low "Estimated" balance is a danger signal. As the bills come through for the space used or the work done, the "Actual" balance will come down toward the "Estimated" until again at the end of the year they meet in the zero which closes the record.

Yearly campaigns may be itemized in advance—entered once in total at the time contracts are signed, on the page current at the time, and deducted then from the "Estimated" balance. The separate parts of the expenditure (for example, the cost of each week's or each month's space in a given campaign) may be noted in pencil on the page of the book which will be current when the bills come in. This will remind the executive of the amounts he will expend during each month. These penciled items are of course disregarded so far as the "Estimated" balance is concerned—they have been deducted once. The lines opposite them in the "Balance" column of "Estimated" may be checked to indicate this. But when the bills actually appear, deduction will be made from the "Actual Balance" column.

Thus it will be evident that the "Actual Balance" column should show the advertising man how his appropriation looks at any time upon the general books; while the "Estimated Balance" column is a guide and reminder.

Space contracts are made on the basis of stipulated rates, and it is easy to schedule ahead what precise costs will be. For certain other types of purchase, however, it may be necessary to figure on approximation, and this may not equal the actual cost. For instance, at the beginning of the year the advertising manager may decide that late in the fall he will get out a catalogue of so many pages, with covers and illustrations and other details more or less vaguely projected. Plainly it is not possible to have full details worked out on every such plan; but the executive will be able to estimate in a general way what the cost will be, and to allow for it while it is still far in the future. As he gets down to work on it, he will correct his first rough approximation with careful computations of the actual costs of the required number of square inches of zinc or half-tone, the amount of paper to be used, the charges for art work and similar details. Finally, when the bills appear, he will note them in the "Actual" columns.

Estimated and Actual Expenditures

At the start, unless the executive has large experience in the printing industry, there will be differences between his "Estimated" and "Actual" expenditures. Adjusting entries may be made as these are discovered, and such entries may be posted to an account of their own. It will be a matter of some satisfaction to notice as the months go by how the number and size of the items so posted decrease. The keeper of the book cannot fail to learn rapidly and thoroughly what a given sum will accomplish; and as his knowledge of

SCHEDULE SHEET FOR........................ DATE..........

STARTED	OPERATION	PROMISED	PROMISED	PROMISED	DELIVERED

FIG. 2 SCHEDULE SHEET

costs increases, his skill as a buyer will automatically grow with it. Not simply precision and definiteness, but an actual increase of product and economy of operation, will appear with this developing skill and knowledge.

Advertising men are likely to be imaginative, and impatient of "bookkeeping" and "red tape." But one, at least, will vouch for the benefit resulting from so much as is represented by the Appropriation Book. Any small labor involved in keeping it has been many times worth while.

When the advertising department's money is budgeted, its work is thereby laid out; for a program of expenditure implies also a program of performance. When space is to be used, copy must be written and art work bought, type must be set and engravings made, and in all probability booklets and letters must be made ready to follow up inquiries or supplement the published advertising. When a big catalogue is issued, much detail must be taken care of. Complex operations must be scheduled. Work must be done accurately, but also on time. First things must be done first.

The story is told that as a train pulled out of a station a man came racing down the platform after it. The train gathered way, however, and the man finally slowed down, turned, and came panting back. "You didn't run fast enough," said the people on the platform. "Yes I did," the man replied, "but I didn't start soon enough." Punctuality of any kind consists largely in starting soon enough. And the first essential of time control is a general program, or time-budget, which will prevent rush work by insuring an early start on each job.

In fact, the problem of scheduling work is rather like that of scheduling expenditure. There is first the general program, and as each item of the plan comes up there is the detailed concise estimate, which finally becomes a record of actual performance. The program corresponds to the money budget; the various follow-up devices correspond to the estimates and analyses described in connection with the Appropriation Book.

A diary may be used to note ahead things which will require future attention—for example, the preparation of copy to fill space already reserved, the getting out of a house organ, the building of a big catalogue for mailing months in advance, and the like. From this general departmental program individual assignments may be made to the persons responsible for different parts of the work. For example, the copywriter will have noted on his desk-calendar reminders which will enable him to perform his duties; the artist must be instructed in ample time to have designs ready so that engravings can be made; and it matters not at all if these things can be done through the advertising agency, the agency must be punctually followed up to see that they are done. Whatever work is needed, from within the department or without, it must be summoned. The program gives the first warning of need.

Production Procedure

But after copy and layout or dummy for a given job have been approved, actual production must begin. Purchase orders will be made for the different concerns which will handle the work. Perhaps there will be art to buy, engravings, type to be set, electrotypes to be made, paper, printing and binding, special envelopes, a dozen details to be handled each by a separate supplier. For each a concise and definite order must be prepared, usually in triplicate. One copy goes to the concern doing the work, one acts as a receiving record, and one is filed for permanent reference. In case the whole job is given to one house, a full description of the job will accompany the order. This description will tell—in the case of a catalogue, for example—the number and size of pages, the type of cover and binding, the colors of ink and paper, the weight of stock to be used, the number of books to be printed, the illustrations, the composition, delivery dates, proofs to be furnished, and similar matters.

While he is making up the orders or description, the advertising manager will find it helpful to prepare a schedule sheet also. The general form of such a sheet is indicated in Fig. 2. Under "Items" will be listed the different operations requiring the executive's attention. If he handles all the work himself, these will be numerous. He must keep track of the art work, the composition, and the like. Having listed these he will talk to the suppliers and get promises of delivery, proofs, or dummies, and such promises will be recorded on the schedule sheet. If he gives the whole job to one concern, he will list only the dates when he is to receive proofs or delivery. The blank will then go into the maturity file or tickler, under the earliest date appearing; and at that time it will act as an automatic reminder of the job. It will be the program for that particular piece of work; and after deliveries are made, it will form a history of the time elements of the work, invaluable as a reference when reordering or as a source of information concerning printers or artists who keep their promises as to delivery dates. As the mass of such information grows, the advertising man will learn pretty definitely how much can be done in a given time, as from the Appropriation Book he learns how much can be accomplished with a given sum. He will have fewer rush jobs, and his work in general will move more smoothly, with greater precision and punctuality. The doing of the work in his head before it is put on paper; the putting on paper before it is actually made in metal and fiber; the anticipation of each part, and the constant checking enforced will make for accuracy. And it cannot be too often repeated that such recording saves time and does not slow up operations.

123456 .... 31 PAGE 15
LAYOUT 1-8-23 .... CHECKED M. H. S.
COPY BY Q. C. H. DATE 2-1-23 CHECKED M.H.S.
NO ILLUSTRATIONS 4 BY W.H.&CO. DATE 2-15-23
CUTS ORDERED 2-15-23 PROMISED 2-25 REC'D 2-25
COMPOSITION ORDERED .... FIRST PROOFS ....
PAGE PROOFS .... O. K. ....
FOUNDRY .... PRINTER ....

FIG. 3 CARD INDEX FOR KEEPING TRACK OF CATALOGUE PAGES

Other Time-Control Devices

Of course the program and the schedule sheet are not the only devices of time control, though they are probably those which will serve for the largest number of average-size jobs in the greatest number of advertising departments. Another time-control device of self-evident usefulness is to classify incoming mail on a basis of urgency, and to handle it accordingly, giving right of way to inquiries and communications demanding immediate attention, and reserving others for investigation. Another is the card-index for keeping track of catalogue pages, one card for each page, mimeographed to show the steps through which the page must pass, noted with a dating stamp as each stage is completed, and filed behind guides assorting the cards by stages. Thus a card might appear as illustrated in Fig. 3 and it would then mean that copy had been written, that art work was completed and cuts made, but that composition was not yet completed nor had page proof been approved; and that these steps were necessary before the page could be sent for electrotyping. The writer has seen elaborate charts designed to keep track of such pages; but the need for this type of time control, and the methods of maintaining it, are familiar, and there seems little purpose in elaborating the matter.

In one sense, perhaps all the working devices of the advertising department or any other, are devices of time control. A manual which tells assistants their duties and prevents unnecessary questions; a filing system which keeps cuts and drawings and negatives promptly available, which provides for storing advertising matter away from dust but near for use; a semiautomatic follow-up that helps make sales but avoids the evil of unintelligent routine; even the Appropriation Book, insuring expenditure at the proper time, becomes a part of the machinery of punctuality. But as punctuality is not the only aim of the department's work, so these time-control mechanisms may also be considered as helping toward accurate and intelligently directed work; and the records made in administering them will prove helpful when the time comes to give an account of what has been done, and to justify it against the things which were planned, in terms of results achieved.

A Traveling Cafeteria to Keep Men on their Jobs

Class Number
658.44415 Cafeteria

HARD physical labor makes men hungry in the middle of the morning. The stomach craves for a glass of milk or a sandwich. That is why in many plants you will look around at about half-past ten for a certain man and find that he has disappeared. If you know the nooks and crannies of the plant you may be able to follow him to some retired corner behind a boiler or in a storehouse, and you will find him sitting on a packing box, a pile of coal, or a beam, with his lunch box open beside him, munching a part of what is supposed to be his noon lunch.

The Mid-Morning Lunch

With the informal camaraderie which is present in all plants, the place to which he betakes himself for his mid-morning lunch is kept confidential by his fellow-workers and his foreman. The rules say that lunch hour starts at noon, but necessity has a stronger rule which is recognized by the wise shop executive, although he may be officially blind to its existence. So you could not find your man unless you had the password.

Men would not interrupt their work if they could get the needed bite to eat without leaving their places. The average plant cannot undertake to bring lunches to the men at their work. The detail and trouble connected with it would be too great. A well-conducted plant, however, would have no objection to letting a lunch man from outside the plant come through the departments on his own initiative, vending eatables to whoever wished to buy them.

A New England factory has the benefit of the little cart shown in the picture, without any expense to the plant itself. This man with his cart is allowed to bring milk, hot dogs, and sandwiches into the factory to the men. He does not run a credit department. His business policy is cash in exchange for the food. In fact, to avoid repeating this business policy to his customers, he has stamped on all four sides of his truck, "No Trust."

FIG. 1 THE TRAVELING CAFETERIA

The workmen do better work, and are present all the morning, their brief lunch causing no extra expense to the company itself.

A Management and Methods Audit

Why Not Periodically Inspect the Organization and Means Through Which Your Money is Spent?

By FREDERICK A. WALDRON

Consulting Engineer

Class Number
657.7 Auditing
657.524:658 Cost Control

IT has been the custom for many years, if not for centuries, to audit the account of financial and industrial organizations for the specific purpose of giving an independent and unbiased opinion of their assets, liabilities, and earning power to the stockholders, board of directors, and the public.

This audit or examination of accounts "reaches under the skin" to a far greater extent than would appear on the surface, and aside from giving the information as to assets and liabilities, it has an influence which is felt by every person who has to do with its accounting and is employed in the work. It also tends to hold in curb dishonest impulses and oftentimes saves the individual from yielding to temptation by falsifying an account, or appropriating money to personal use, as the audit insures discovery of errors or dishonesty.

It would not be wise to enter into all of the psychological reasons leading up to the practice of auditing accounts, but it could be stated that ultimately it is the influence on "personal interests" that makes the audit worth the time, trouble, and money it costs.

As the function of the audit is to examine and certify to the correctness of the work done by the financial and accounting departments of an organization, it does not in any way show or suggest facts relative to economical disbursements of the funds recorded in the account which has been certified to as being correct.

In any industrial concern:
How many pay-roll dollars are wasted by inefficient labor?
How many capital dollars are wasted by injudicious purchases?
How quickly will unwise capital expenditures and poor management stop profits and bring the receiver?

Mr. Waldron advocates an audit of both management and methods to reveal these losses. He estimates the cost as far below the gains, putting it from \$250 to \$10,000 per year depending upon the extent and frequency of the examination.

How Does an Audit Pay?

Wherein and how does this audit pay? It pays in various ways both morally and financially. In the moral way it pays by restraining, in part, the employee's dishonest impulse. It also tends toward greater accuracy and thoroughness in his work, for he knows any discrepancy will ultimately be discovered by the auditor. It helps the owner financially by telling him the facts from an independent and cold-blooded viewpoint, and also suggests ways and means by which policies may be changed or expenditures controlled.

This method has for years been used by the Mutual Insurance Companies in auditing or placing a physical criticism and value on the fire fighting and resisting properties of large industries, resulting in an insurance rate that has heretofore been unknown. This "audit" has been termed inspection and the efficiency of the inspection department of the Mutual Fire Insurance Companies and the results obtained by them are well known.

It would therefore seem more than passing strange that the possibility of audit or inspection has not been given more serious consideration as to its application to management and methods. *Here the large sums of money are expended for labor and material. How do you know that your manager or organization and the methods used in your factory are efficient and accurate as the work of your accounting department or the methods used in maintaining your fire protection?*

There are many, many questions which would receive far more attention and consideration than they do if the executives and rank and file of a large corporation knew they were being checked up. In many cases, such an inspection would result in expediting and lowering the cost of work and increasing efficient co-operation between departmental heads.

As an illustration, the following situation came to my notice some years ago. In visiting a large corporation, the president remarked that the co-operation in his organization was perfect. Later, I had occasion to go into some details and found that during my entire experience I had never found an organization where there was more undercurrent and silent backbiting and discontent than existed in a few of the departments, due almost entirely to the departmental head who could not get along with his equals, fawned on his superiors, and bullied those subordinate to him.

In another case a department head balked under certain conditions, sat back and took absolutely no initiative in active matters. In other words, he pursued a line of passive resistance without disobeying orders or crossing anyone. The effect, however, was far-reaching in a considerable reduction of speed of output, and the enthusiasm essential to a well-organized industry.

Oftentimes, the principles involved in one organization should be carried out in an absolutely different manner in another organization. Failure to apply properly such principles results in catastrophe.

These illustrations are a few of the glaring conditions revealed by the management audit. Remarkable results come from the detailed audit of manufacturing methods by well-seasoned, experienced men who can with common sense and foresight see at a glance where methods can be improved either in the speed of production or an increase in quality of product.

If it is profitable and advisable to certify to the correctness of additions, subtractions, multiplications, and divisions by the office boy, timekeepers, and comptrollers, why should it not be more advantageous to have an audit of the ways and means through which money is expended, examined periodically, in order that extravagances or defects in such ways and means could be anticipated and prevented before they reached the ledger? Has the question ever been answered as to how many dollars have been taken from the pay-roll by the minutes and hours of inefficient labor? How many dollars have been wasted by injudicious purchase of materials? How many firms have been placed in the hands of the receivers from poor judgment in the direction of capital expenditures and general management?

Would not the application of audit methods and principles to the management and methods of industrial or commercial organizations, answer the above questions?

The moral and commercial effect of a thorough audit which reports the conditions as found, with constructive suggestions, placed in the hands of the directors or executives of a corporation, has an effect that is most beneficial and far-reaching in its earning power and is further developed by periodical "follow up" inspections.

Effect of a Management Audit on the Personnel

It does not take a vivid imagination to realize the effect on a superintendent, assistant superintendent, foreman, engineer, draftsman, or other employee in having their good qualities and their shortcomings reported periodically to the controlling board of an organization. Its effect would be indelibly impressed upon the mind and actions of all with resulting benefit.

From the preceding analysis a conclusion should readily be reached that the audit of management and method at a reasonable cost by a competent critic would result in a more concerted and organized effort to increase the efficiency of an organization. With this taken for granted the question naturally arises: How can this be done? As a tentative plan, the writer has outlined the following list of the principal selective points on which the board of directors may base its requirements, so that it would only remain for it to select a person of intergrity and experience to visit at unexpected periods the company's offices or factories for the purpose of examination and report upon such items as may have been selected.

After this report has been made, the board of directors can then determine the number and frequency of follow up visits for the purpose of reporting on the progress made in the carrying out of initial recommendations made in the audit. A full audit would cover all the items outlined in the selective list and if desired, certain features might be selected from the initial report for special attention for a given period.

SELECTIVE LIST OF AUDIT ITEMS

MANAGEMENT	METHODS
1. Functional division	1. Fire protection
2. Personnel	2. Order and neatness
3. Maintenance	3. Heat
4. Engineering (Design, drafting-room control, manufacturing methods.)	4. Light
	5. Power
	6. Occupancy of building
5. Production	7. Design of product
6. Shop accounting (Timekeeping, stock record, material record.)	8. Planning and routing
	9. Machine records
	10. Tool design
7. Allocation of overhead	11. Store methods
8. Depreciation of policies	12. Toolmaking and upkeep
9. Personal relation	13. Handling of work
10. Welfare	14. Machine repair
11. Departmental arrangement	15. Motor repair and inspection
12. Future demands	
	16. Belts and care

With the above list available, we can assume that it is desired to improve a managerial organization by an audit of items 1 to 12 inclusive, with the object in view of (a) reducing the cost of management, or, (b) increasing the efficiency of the present management, by examining and analyzing the different functions and recommending constructive methods of improvement and the ways and means of carrying such recommendations into effect.

The same procedure would be followed in the audit of methods, items 1 to 16 inclusive, it being optional with the management to select any number or all of these items for the first audit with a selective list of special items on which efforts for improvement should be concentrated, as for instance, tool design. It is quite common in the audit or examination of shop methods to find a jig or fixture in use which requires more time to put the piece in place than to perform the operation. It may be found that the locating points are improperly placed or defective, producing inaccurate or defective work. A careful study of such conditions invariably reveals the possibilities of greatly increasing the net production by reducing the time of operation and amount of spoiled work.

The audit or examination of machine and tool repairs and upkeep has resulted in increased production by systematic methods of inspection, arrangement, and sharpening of tools. Also having the machine in condition to do the work at the exact time that the workman is ready to start upon a specific job.

As there are upward of 50 reasons why a workman cannot turn out a full day's work due to factory conditions beyond his control, and it would seem logical that if some of these can be eliminated by audit methods, the results would be far-reaching and worth many times more than the audit would cost.

Having reviewed the question of the conditions of an audit of this kind, and illustrated in a general way how it is accomplished, the reader naturally asks the question: "How much would an audit cost?"

This can be answered by a general statement that it would be worth in any case more than was paid for it, and would depend on the extent to which the work was carried and the number of plants in the same vicinity requiring audit service, as the expense of travel divided among two or three plants would be less than if such expense had to be borne by one plant. Further, the number of visits per annum would also be a controlling factor in the expense.

An audit covering three or four items under each of the preceding headings might cost from $300 to $1000, whereas a full and complete audit of all the items under the preceding headings might reach the sum of $2000 to $3000. On the other hand, a single item under each of these headings might not exceed $250.

The application of the audit and its resulting benefits needs no additional argument to establish its usefulness and value. Governments, banks, commercial houses, stores, and factories, all recognize the value of an independent review and checking up of the clerical and accounting work required within their organizations; and it can be assumed that the application of the audit to methods and management would help solve many problems which exist in the commercial and industrial world.

As to what the effect would be and how soon it would take place depends almost entirely on the practical and complete phases of the audit. Care should be taken in work of this kind not to overstate facts, and each item of a critical nature should be supplemented by one or more constructive suggestions.

It is a cardinal principle of the successful business man to "check up" all matters requiring decisive answers. It is also an [illegible] principle which is recogn[illegible] that the effect of "checking up" [illegible] employer and employee alike. With the employer it gives him better service and with the [illegible] keeps him "on his toes" both as to quantity and quality of work performed.

Confronted by the preceding facts, would not a board of directors or business executives be justified in the expenditure of an amount of money equal to or even in excess of that paid for the periodical audit of their accounts in order that they might have placed before them a document which would, figuratively speaking, give the "blood pressure" of their management and methods and enable them to apply corrective measures before it is too late?

The expense would not be burdensome and might range from $250 to $10,000 per year depending on how far the volume of output would warrant the expense.

As an illustration, the minimum figure above mentioned might include two visits a year on one or two items of the preceding list. The maximum figure might include four or six visits a year and cover the major portions of the items listed.

It is impossible to state what the results might be in dollars and cents as this would depend entirely upon the response of the management to the recommendations that might be made in the initial audit.

It might be, however, in the study of a perfect organization, that the results would be nil, but the satisfaction of knowing that such an organization was rated at 100 per cent would undoubtedly be worth much more than the cost of the audit.

The Post Office in Line for Standardization

By EDWARD M. MORGAN

Postmaster, City of New York

Class Number
383 Postal Service

REPORT comes that the efforts which recently have been made to secure uniformity in the size of catalogues is bearing good fruit; that progress is being made by the National Association of Warehousemen towards the standardization of receipts and other warehouse forms; that purchasing agents through their organizations are preparing forms for purchase orders, requisitions, and vouchers. Not only are business organizations working for standardization but the government also is active.

The Bureau of Standards is, of course, always urging standardization for the promotion of efficiency and the furtherance of the interests of American industries. The Department of Commerce through its Division of Simplified Practice is reported to be trying to solve the complications involved in the standardizing of bank checks, but it is with the work of the post office in connection with standardization that this article is concerned. The Post Office Department, in line with its other progressive movements, has been doing its utmost to standardize the size of envelopes and mailing cards, or at least to limit from general use undersized cards and envelopes and those of freakish design.

For many years, manufacturers of cards and envelopes manufactured, without protest from anyone, freakish forms of both cards and envelopes. The handling and disposition of these in the mails added greatly to the burden of the postal system. Nearly all cards, circulars, and letters are postmarked in the post office by means of postmarking machines. These are operated by electric power at very high speed. Letters, cards, etc., are run through the machines in veritable ribbons of light. The operation is so rapid that the eye cannot detect the movement of the individual piece. The rate is 25,000 letters, or even slightly more, per hour. The machines obviously have to be designed and regulated principally for the normal size envelope or card, and where envelopes or cards are used which are of freakish design or considerably smaller than the normal size, they not only escape the postmark but commonly derange the normal procession of the letters through the mechanism and thus jam the machine. This gives much trouble to the operators, and of course slows up the movement of the mail.

The Post Office Department, to overcome this evil, has recently been urging the manufacturers of cards and envelopes not to make them smaller than 2¾ by 4 inches. The campaign has had its effect. Manufacturers have recognized the justification of the government's appeal and the number of small size cards and envelopes observed in the mails has been materially reduced. Advertisers and the public generally have a personal interest in this matter also, for not only do the cards and envelopes of small and irregular shape interfere with the efficient operation of the postmarking machines, but they are particularly likely to slip out of the packages into which letters are made preparatory for transmittal from one office to another. When they thus become loose in the mail bags or pouches, they are likely to escape observation and suffer delay in delivery.

Provision for Advertising Matter

The government, through the postal administration, has for some time been showing itself receptive to the suggestions of the business interests in respect to suggested changes in methods and systems. One suggestion that has been urged by certain advertisers, and which is being given careful attention, is the proposed provision for the use of special cards and envelopes for enclosure with advertising matter, bearing the address of the advertiser. These the recipients could deposit in the mails without postage, yet with the knowledge that they would be transmitted to the original sender (the advertiser) by the post office, postage to be collected from him. This would enable advertisers to avoid the waste of enclosing stamped self-addressed envelopes with their advertising matter sent to prospective customers, only a percentage of which would be likely to be used.

Under the proposed plan they would be required to pay postage only on the particular letters or cards which would be remailed to them by their prospects. No legislation in respect to this has yet been adopted, and there are certain service features which present difficulties in the accomplishment of the purpose, but the proposition is being given the study it deserves. The adoption of this plan would promote standardization, as the cards or order forms would all come in of uniform size, suitable for office handling and filing by advertisers.

Every effort is being made by the government to standardize the form of address upon mail matter. Uniformity in the location of the "card of the sender," in the placing of the address, and in the affixing of the stamp is of material consequence. Freakish forms of address, unconventional methods of affixing stamps, the omission of the card of the sender, or the placing of the card in other than the approved position in the upper left corner of the envelope or wrapper, are all evils that tend to slow up the movement of the mails, and add to the expense of operation.

Publications have long been in the habit of permitting their employees to paste address labels on publications mailed without envelopes or wrappers in a most promiscuous fashion, up-side down, crosswise, here, there, and everywhere over both front and back covers. It can be well understood how this objectionable practice retards the speed of the separator, who has to turn the publication being handled by him over and over, back and forth, this way and that way before he can locate the address and get it right side up so that he can read it. The Post Office Department has, after investigation, indicated two most desirable places for the address slip: (a) upside down on the lower left corner of the front cover, and (b) horizontally, right side up in the upper right corner of the back cover. Of course it is understood that whatever method is adopted for any particular publication, should be followed for all copies of it that may be mailed.

In the handling of publications with the address label as first indicated, the distributor would hold a pile of them, front cover up, on his left forearm, clasped with his left hand, with the bound edge convenient to his right hand, the publication being upside down, but the address being thus brought right side up. The leaves would thus not open up when he puts the magazine in the box or sack. A similar procedure is followed when the address appears on the back cover.

Suggested Standardization

Other forms of standardization urged by the Post Office Department are as follows:

1. Unusually small publications should be inclosed in envelopes.
2. Publications mailed in single wrappers should be flat, not rolled.
3. Publications should be folded to a size not larger than 9 by 12 in., if possible.
4. Addresses should be in type not smaller than 10 point or in a legible hand.
5. Old newspapers should not be used as wrappers. Ink should be black or of strongly contrasting color, and envelopes, wrappers, and label paper should be white or of light tint.
6. Separation of copies to rural and to city subscribers facilitates distribution.
7. Statement that mail is second class should appear on all wrappers and envelopes.
8. Care should be taken about paste on labels. Too little permits the label to fall off and too much makes the publications stick so that when they are torn apart the legibility of the address is destroyed.

While these provisions as to standardization are designed for second-class matter, the principles on which they are based should govern the preparation of advertising matter and other miscellaneous printed matter, in so far as they are applicable. If manufacturers and others who make large use of the mails will follow these suggestions, the results will be beneficial to all concerned.

Pension Costs and the Labor Turnover Factor

Method of Determining the Cost as a Percentage of Pay-roll

By JOSEPH H. WOODWARD

[illegible]

EXACTLY how does labor turnover affect the cost of pensions. This is one of the perplexing questions with which an employer is called upon to deal in the establishment of a systematic plan for the retirement of his superannuated employees. It is obvious that if the labor turnover in an establishment were so great that none of the employees remained in the service until attaining the pensionable age there would be no superannuated employees to be retired. In such an extreme instance a pension system would cost the employer nothing whatever. At the other extreme, if the labor turnover were nil every employee who did not die would eventually receive a pension and the cost of a pension system would be high. In actual practice the labor turnover will lie between these two extremes and the cost of the pension system will vary accordingly.

Labor Turnover and Pension Systems

It is the purpose of this article to show by numerical calculations how much variation in the cost of a pension system is produced by a given variation in the rate of labor turnover, the other factors entering into cost of the pension system remaining unchanged. By presenting actual calculations it is hoped that the employer will be able to visualize in a concrete way the extreme importance of the rate of labor turnover in estimating the cost of a pension plan and to grasp the actuarial method of solving the problem. The formulae employed have been so simplified that very little mathematical knowledge is required to understand them.

In order to make a clear presentation it is assumed that the plan is non-contributory and provides only one benefit, namely, a pension to commence on the attainment of age 65, the annual amount of which is equal to the sum of 2 per cent of the salary at date of retirement multiplied by the number of completed years of service. Whatever may be said in theory as to the advantages of a system under which pensions are regarded strictly as a form of deferred pay, with the consequent necessity that employees who resign or are dismissed should be allowed to take with them their equitable share in the pension fund, it is nevertheless true in practice that, except under contributory plans, it is generally the desire of the employer to pay benefits only to those who reach the retirement age.

The only factors other than the rate of labor turnover entering into the cost of the pension plan are the rate of mortality, the rate of interest, and the salary scale. The rate of mortality assumed throughout the calculations is taken from the United States Life Tables, 1910, published by the United States Bureau of the Census. The rate of interest assumed is 5 per cent. The salary scale has been chosen to represent the wage conditions existing in a typical industrial establishment. Since both the pension and the contributions are a percentage of salary it is not necessary to know the absolute salary at each age but merely the *ratio* of the salary at each age to the salary at age 65.

The assumed rates of withdrawal from service require a somewhat fuller explanation. A study of labor turnover statistics by length of service shows that the rate of withdrawal for the first two years of service is greatly in excess of the rates for later years and is much more susceptible to fluctuations arising from the alternate depression and expansion of business. Temporary labor, casual employees, and a great number of floating employees who rarely continue in any establishment for more than a few months serve to increase such fluctuations. In order to avoid undue and unnecessary complexity in the task of estimating the cost of a pension plan it is desirable to ignore the pay-roll of such employees entirely and take as the basis of the calculation only the pay-roll of those employees having two years or more service to their credit. Furthermore, the treatment of the problem in this manner makes it possible to consider that all employees of the same attained age experience the same rate of withdrawal regardless of the length of time for which they have been in service.

How the Calculations Are Made

The following calculations, then, have been placed upon what might be called a two-year preliminary term basis. Each employee has been assumed to enter the pension plan only upon the completion of a term of two years following the date of employment. The rates of contribution represent percentages of salary remaining level or constant during the term of employment and depending upon the age of the employee at entry into the plan. This age at entry is exactly two years greater than the age at entry into the service, although in determining the amount of pension payable, the full number of completed years of service is used. The accumulation to provide the pension, however, is commenced only after the employee has been in the service for two years and no contributions are set aside out of the pay-roll for the first two years.

TABLE 1. SERVICE TABLE. MORTALITY TABLE WITH RATES OF WITHDRAWAL FROM EMPLOYMENT AND SALARY SCALE

Exact Age	Rate of Mortality per Thousand	High Rate of Withdrawal: Rate of Withdrawal per Thousand (Excluding first two years of service)	High Rate of Withdrawal: Of 100,000 Employees Entering Pension Plan at Age 20 after Two Years of Service				Low Rate of Withdrawal: Rate of Withdrawal per Thousand (Excluding first two years of service)	Low Rate of Withdrawal: Of 100,000 Employees Entering Pension Plan at Age 20 after Two Years of Service				No Rate of Withdrawal: Of 100,000 Employees Entering Pension Plan at Age 20 after Two Years of Service		Salary Scale
	Number of Deaths in one year among 1,000 aged x at beginning of year	Number of Withdrawals in one year among 1,000 aged x at beginning of year	Number alive and in service at exact age x	Number of Deaths between ages x and $x+1$	Number of Withdrawals between ages x and $x+1$	Number of Deaths and Withdrawals between ages x and $x+1$	Number of Withdrawals in one year among 1,000 aged x at beginning of year	Number alive and in service at exact age x	Number of Deaths between ages x and $x+1$	Number of Withdrawals between ages x and $x+1$	Number of Deaths and Withdrawals between ages x and $x+1$	Number alive and in service at exact age x	Number of Deaths between ages x and $x+1$	Salary at age x corresponding to a salary of 1000 at age 65
x	$1000\,q^d_x$	$1000\,q'_x$	l_x	d_x	w_x	d_x+w_x	$1000\,q''_x$	l_x	d_x	w_x	d_x+w_x	l_x	d_x	$1000\,s_x$
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
20	4.9	200.0	100,000	490	20,000	20,490	100.0	100,000	490	10,000	10,490	100,000	190	540
21	5.2	199.8	79,510	413	15,886	16,299	99.9	89,510	465	8,942	9,407	99,510	517	600
22	5.4	199.0	63,211	341	12,579	12,920	99.5	80,103	433	7,970	8,403	98,993	535	654
23	5.4	197.8	50,291	272	9,948	10,220	98.9	71,700	387	7,091	7,478	98,458	532	702
24	5.5	196.2	40,071	220	7,862	8,082	98.1	64,222	353	6,300	6,653	97,926	539	744
25	5.5	194.0	31,989	176	6,206	6,382	97.0	57,569	317	5,584	5,901	97,387	536	781
26	5.6	191.4	25,607	143	4,901	5,044	95.7	51,668	289	4,945	5,234	96,851	542	813
27	5.8	188.2	20,563	119	3,870	3,989	94.1	46,434	269	4,369	4,638	96,309	559	841
28	6.1	184.8	16,574	101	3,063	3,164	92.4	41,796	255	3,862	4,117	95,750	584	865
29	6.3	181.0	13,410	84	2,427	2,511	90.5	37,679	237	3,410	3,647	95,166	600	886
30	6.6	176.6	10,899	72	1,925	1,997	88.3	34,032	225	3,005	3,230	94,566	624	904
31	6.9	172.0	8,902	61	1,531	1,592	86.0	30,802	213	2,649	2,862	93,942	648	919
32	7.3	167.0	7,310	53	1,221	1,274	83.5	27,940	204	2,333	2,537	93,294	681	932
33	7.7	161.6	6,036	46	975	1,021	80.8	25,403	196	2,053	2,249	92,613	713	943
34	8.1	156.0	5,015	41	782	823	78.0	23,154	188	1,806	1,994	91,900	744	952
35	8.5	150.0	4,192	36	629	665	75.0	21,160	180	1,587	1,767	91,156	775	959
36	8.9	143.8	3,527	31	507	538	71.9	19,393	173	1,394	1,567	90,381	804	965
37	9.2	137.4	2,989	27	411	438	68.7	17,826	164	1,225	1,389	89,577	824	971
38	9.5	131.0	2,551	24	334	358	65.5	16,437	156	1,077	1,233	88,753	843	976
39	9.9	124.2	2,193	22	272	294	62.1	15,204	151	944	1,095	87,910	870	980
40	10.2	117.4	1,899	19	223	242	58.7	14,109	144	828	972	87,040	888	983
41	10.6	110.4	1,657	18	183	201	55.2	13,137	139	725	864	86,152	913	986
42	11.0	103.4	1,456	16	151	167	51.7	12,273	135	635	770	85,239	938	988
43	11.5	96.6	1,289	15	125	140	48.3	11,503	132	556	688	84,301	969	990
44	12.1	89.6	1,149	14	103	117	44.8	10,815	131	485	616	83,332	1008	992
45	12.6	82.6	1,032	13	85	98	41.3	10,199	129	421	550	82,324	1037	993
46	13.3	75.8	934	12	71	83	37.9	9,649	128	366	494	81,287	1081	994
47	13.8	69.0	851	12	59	71	34.5	9,155	126	316	442	80,206	1107	995
48	14.4	62.6	780	11	49	60	31.3	8,713	125	273	398	79,099	1139	996
49	15.0	56.2	720	11	40	51	28.1	8,315	125	234	359	77,960	1169	997
50	15.5	50.0	669	10	33	43	25.0	7,956	123	199	322	76,791	1190	997
51	16.2	44.0	626	10	28	38	22.0	7,634	124	168	292	75,601	1225	998
52	17.2	38.4	588	10	23	33	19.2	7,342	126	141	267	74,376	1279	998
53	18.5	33.0	555	10	18	28	16.5	7,075	131	117	248	73,097	1352	998
54	19.9	28.0	527	10	15	25	14.0	6,827	136	96	232	71,745	1428	998
55	21.5	23.4	502	11	12	23	11.7	6,595	142	77	219	70,317	1512	999
56	23.3	19.0	479	11	9	20	9.5	6,376	149	61	210	68,805	1603	999
57	25.1	15.2	459	12	7	19	7.6	6,166	155	47	202	67,202	1687	999
58	26.8	11.8	440	12	5	17	5.9	5,964	160	35	195	65,515	1756	999
59	28.7	8.6	423	12	4	16	4.3	5,769	166	25	191	63,759	1830	999
60	30.8	6.0	407	13	2	15	3.0	5,578	172	17	189	61,929	1907	1000
61	33.0	3.8	392	13	1	14	1.9	5,389	178	10	188	60,022	1981	1000
62	35.4	2.2	378	13	1	14	1.1	5,201	184	6	190	58,041	2055	1000
63	38.1	1.0	364	14	0	14	0.5	5,011	191	3	194	55,986	2133	1000
64	40.9	0.2	350	14	0	14	0.1	4,817	197	0	197	53,853	2203	1000
65	....	....	336	....	....	....	....	4,620	....	....	....	51,650	....	1000

TABLE 2. COST OF PENSIONS AS AFFECTED BY RATES OF WITHDRAWAL FROM EMPLOYMENT

Age at Entry Into Pension Plan	Pension at Age 65 Corresponding to a Salary of 1000 at Age 65	High Rate of Withdrawal: $\left(\frac{1}{1.04}\right)^x s_x l_x$	High Rate of Withdrawal: $D_x + D_{x+1} + \ldots + D_{64}$	High Rate of Withdrawal: $\{65-(x-2)\}0.02$ times $\left(\frac{1}{1.04}\right)^{65} l_{65}$	High Rate of Withdrawal: Cost of Pension Plan Per Cent of Salary	Low Rate of Withdrawal: $\left(\frac{1}{1.04}\right)^x s_x l_x$	Low Rate of Withdrawal: $D_x + D_{x+1} + \ldots + D_{64}$	Low Rate of Withdrawal: $\{65-(x-2)\}0.02$ times $\left(\frac{1}{1.04}\right)^{65} l_{65}$	Low Rate of Withdrawal: Cost of Pension Plan Per Cent of Salary	No Rate of Withdrawal: $\left(\frac{1}{1.04}\right)^x s_x l_x$	No Rate of Withdrawal: $D_x + D_{x+1} + \ldots + D_{64}$	No Rate of Withdrawal: $\{65-(x-2)\}0.02$ times $\left(\frac{1}{1.04}\right)^{65} l_{65}$	No Rate of Withdrawal: Cost of Pension Plan Per Cent of Salary
x	$\{65-(x-2)\}0.02$ times 1000	D_x	N_x	a_{65} = 7.9763	100{(20)÷(19)}	D_x	N_x	a_{65} = 7.9763	100{(24)÷(23)}	D_x	N_x	[illegible]	100{(28)÷(27)}
16	17	18	19	20	21	22	23	24	25	26	27	28	29
20	940	20,352	108,690	105.70	0.10	20,352	202,630	1453.1	.72	20,352	[illegible]	[illegible]	[illegible]
21	920	17,124	88,338	103.45	0.12	19,277	182,278	1422.1	.78	21,431	[illegible]	[illegible]	[illegible]
22	900	14,132	71,214	101.21	0.14	17,909	163,001	1391.2	.85	22,132	497,[illegible]	[illegible]	[illegible]
23	880	11,494	57,082	98.96	0.17	16,387	145,092	1360.3	.94	22,503	[illegible]	[illegible]	[illegible]
24	860	9,244	45,588	96.71	0.21	14,815	128,705	1329.4	1.03	22,[illegible]	[illegible]	[illegible]	[illegible]
25	840	7,378	36,344	94.46	0.26	13,277	113,890	1298.5	1.14	22,160	429,079	[illegible]	[illegible]
26	820	5,855	28,966	92.21	0.32	11,814	100,613	1267.6	1.26	22,14[illegible]	407,[illegible]	[illegible]	[illegible]
27	800	4,632	23,111	89.96	0.39	10,460	88,799	1236.6	1.39	21,[illegible]	38[illegible],[illegible]74	[illegible]	[illegible]
28	780	3,657	18,479	87.71	0.47	9,223	78,339	1205.7	1.54	21,128	363,679	[illegible]	[illegible]
29	760	2,887	14,822	85.46	0.58	8,110	69,116	1174.8	1.70	20,484	342,[illegible]	[illegible]	[illegible]
30	740	2,280	11,935	83.21	0.70	7,118	61,006	1143.9	1.88	19,780	322,067	12,788	[illegible]
31	720	1,803	9,655	80.96	0.84	6,238	53,888	1113.0	2.07	19,024	302,287	12,44[illegible]	[illegible]
32	700	1,430	7,852	78.72	1.00	5,465	47,650	1082.1	2.27	18,248	28[illegible]	12,097	[illegible]
33	680	1,138	6,422	76.47	1.19	4,788	42,185	1051.1	2.49	17,456	26[illegible],015	11,751	[illegible]
34	660	909	5,284	74.22	1.40	4,196	37,397	1020.2	2.73	16,654	247,559	11,406	[illegible]
35	640	729	4,375	71.97	1.65	3,679	33,201	989.3	2.98	15,848	230,905	11,060	[illegible]
36	620	588	3,646	69.72	1.91	3,231	29,522	958.4	3.25	15,059	215,057	10,715	[illegible]
37	600	477	3,058	67.47	2.21	2,846	26,291	927.5	3.53	14,302	199,998	10,369	[illegible]
38	580	390	2,581	65.22	2.53	2,512	23,445	896.6	3.82	13,566	185,696	10,023	[illegible]
39	560	321	2,191	62.97	2.87	2,222	20,933	865.6	4.14	12,849	172,130	9,678	[illegible]
40	540	265	1,870	60.72	3.25	1,970	18,711	834.7	4.46	12,153	159,281	9,332	[illegible]
41	520	221	1,605	58.47	3.64	1,752	16,741	803.8	4.80	11,492	147,128	8,986	[illegible]
42	500	185	1,384	56.23	4.06	1,562	14,989	772.9	5.16	10,850	135,636	8,641	[illegible]
43	480	157	1,199	53.98	4.50	1,397	13,427	742.0	5.53	10,241	124,786	[illegible]	[illegible]
44	460	133	1,042	51.73	4.96	1,254	12,030	711.1	5.91	9,660	114,545	[illegible]	[illegible]
45	440	114	909	49.48	5.44	1,127	10,776	680.2	6.31	9,098	104,88[illegible]	7,604	[illegible]
46	420	98	795	47.23	5.94	1,017	9,649	649.2	6.73	8,564	95,78[illegible]	[illegible]	[illegible]
47	400	85	697	44.98	6.45	920	8,632	618.3	7.16	8,056	87,[illegible]	[illegible]	[illegible]
48	380	75	612	42.73	6.98	834	7,712	587.4	7.62	7,574	79,[illegible]	[illegible]	[illegible]
49	360	66	537	40.48	7.54	759	6,878	556.5	8.09	7,117	71,[illegible]	[illegible]	[illegible]
50	340	58	471	38.23	8.12	692	6,119	525.6	8.59	6,676	64,176	[illegible]	[illegible]
51		52	413			633	5,427			6,266	57,800		
52		46	361			580	4,794			5,871	[illegible]		
53		42	315			532	4,214			[illegible]	[illegible]		
54		38	273			489	3,682			[illegible]	[illegible]		
55		34	235			450	3,193			4,800	[illegible]		
56		31	201			414	2,743			[illegible]	[illegible]		
57		28	170			382	2,329			4,161	[illegible]		
58		26	142			352	1,947			[illegible]	[illegible]		
59		24	116			324	1,595			[illegible]	[illegible]		
60		22	92			299	1,271			[illegible]	[illegible]		
61		20	70			275	972			3,060	[illegible]		
62		18	50			253	697			2,818	[illegible]		
63		17	32			232	444			[illegible]	[illegible]		
64		15	15			212	212			[illegible]	[illegible]		
65													

To show the effect of a change in the rate of withdrawal upon the cost of the pension plan calculations have been made on three different bases:

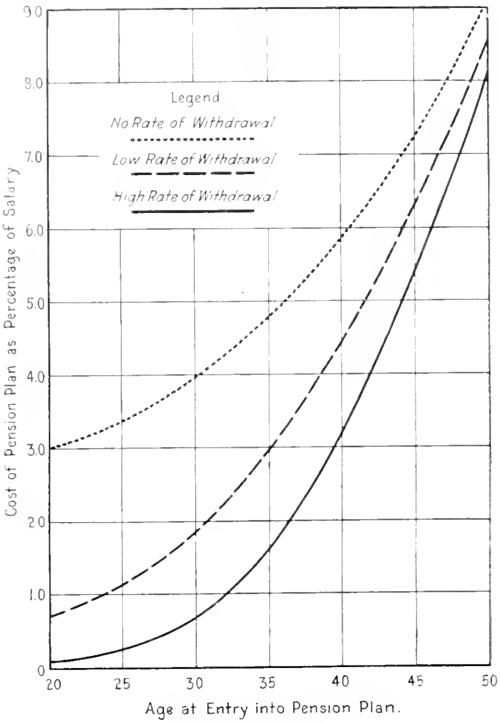


FIG. 1 PERCENTAGE OF SALARIES TO SET ASIDE FOR PENSION FUND

1. A "High Rate of Withdrawal" which commences at a withdrawal rate of 200 per 1000 per year (i. e., 20 per cent per year) at age 20, and decreases as the age increases.
2. A "Low Rate of Withdrawal" which commences at a withdrawal rate of 100 per 1000 per year (i. e., 10 per cent per year) at age 20, and decreases as the age increases. (At all ages the withdrawal rate under (2) is just one-half of the withdrawal rate under (1).)
3. A "No Withdrawal Rate" which assumes that the rate of withdrawal is nil. (This case is also applicable to show the cost of the pension plan when a withdrawing employee is permitted to take with him on withdrawal the contributions accumulated at compound interest.)

The basic table in any pension fund calculation is called the Service Table. (See Table 1.) This table is mathematically the same kind of a table as the mortality table used by a life insurance company except that in addition to showing the rate of mortality, it also shows the rate of withdrawal and the salary scale for each age. Starting with 100,000 active employees assumed to enter the table at age 20 after two years of service, we proceed by applying the respective rates of death and withdrawal at each successive age to show the number of deaths and of withdrawals in each year. The number of survivors at each attained age out of an original group of 100,000 is obtained by subtracting the number of deaths and withdrawals during the year from the number of survivors at the previous attained age. For example, in the columns of Table 1 based on a high rate of withdrawal, 336, the number of survivors at age 65, is the number of employees out of 100,000 entrants at age 20, or 10,899 entrants at age 30, or 1,899 entrants at age 40, who will be entitled to a pension. The headings in the service table are so arranged as to explain fully the meaning of the figures presented.

Rates of mortality are not shown in the service table for ages higher than 65, the pensionable age. In determining the value of a life pension at this age, the rate of mortality assumed is that of the United States Life Tables, 1910.

Table 2 shows the computations to arrive at the percentage of the wages which must be set aside for each age at entry into the pension plan (two years after entry into employment) in order to provide the pension benefits under the assumptions indicated. The following formula was used in making the computations. (See Tables 1 and 2 for meanings and values of symbols):

$$\text{Cost of Pension Plan} = 100\frac{[65-(x-2)]0.02\left(\frac{1}{1.05}\right)^{65} l_{65}\bar{a}_{65}}{{}^{s}N_x}$$

where x = age at entry into Pension Plan
and $\bar{a}_{65}$ = 7.9763 is the present value of a life annuity of one dollar per annum payable monthly at age 65.

$$\text{and } {}^{s}N_x = {}^{s}D_x + {}^{s}D_{x+1} + {}^{s}D_{x+2} + \cdots + {}^{s}D_{64}$$

$$\text{where } {}^{s}D_x = \left(\tfrac{1}{1.05}\right)^x s_x l_x$$

An examination of the rates of contribution shown in columns 21, 25, and 29 of Table 2 answers the question which we set for ourselves at the outset. The effect of the withdrawal rate on the cost of the pension plan is seen to be much greater at the younger ages of entry into the plan than where the employee enters the plan at an advanced age. As compared with the cost of a pension where no withdrawal rate is assumed or where the withdrawing employee takes with him his accumulated share in the fund, the cost of the plan is reduced by the effect of the "High Rate of Withdrawal" about 97 per cent at age 20, $(100-\frac{0.10}{3.01})$, 82 per cent at age 30. $(100-\frac{0.70}{3.97})$, 45 per cent at age 40, $(100-\frac{3.25}{5.86})$, and 11 per cent at age 50. $(100-\frac{8.12}{9.11})$. The effect of the "Low Rate of Withdrawal" is to reduce the cost of the plan about 76 per cent at age 20, 53 per cent at age 30, 24 per cent at age 40, and 6 per cent at age 50. Fig. 1 shows graphically the percentage costs listed in columns 21, 25, and 29 of Table 2.

The problem of providing for the "accrued liability" —the rock upon which so many pension funds have come to grief—does not come within the scope of this article. A danger signal, however, should be hung out at this point. When the plan is made to apply to an existing body of employees, and credit is given for years of service completed before the effective date of the plan, special means must be adopted to provide the necessary accumulations in respect of such past years of service. Otherwise the plan will not be financially solvent.

Finance and Common Sense

By C. L. EIERMANN

[illegible] Manager, Rhoads [illegible]

ORGANIZATIONS that fail to weather the storms of industry can, for purposes of discussion, be placed in two main divisions: first, those which appreciate the problems of production and sales but do not grasp the problems of finance; second, those which appreciate the intricacies of finance but are unable to put the necessary "punch" into their production and sales departments.

A group of bankers had occasion recently to investigate a large and well-known textile organization. This organization has come to them for financial relief at a time when such an application was least expected. Its volume of sales was considered satisfactory, its mills were producing the goods required, and no program of expansion had been inaugurated or contemplated. What, however, had been entirely overlooked, was a constructive financial policy operating in conjunction with the sales and production program. Neither the executive head of the organization, who was a very capable sales manager, nor the directors as a body had intelligently anticipated this requirement of the business nor did they see the danger of the omission until they came close to disaster.

> **The management of the finances of a business is one of the most important duties of its executive and one in which he fails most frequently. Mr. Eiermann gives many practical suggestions for the proper handling of financial matters, emphasizing particularly the necessity of co-ordinating the financial program with the sales and production programs.**

A good sales executive is by nature optimistic and enthusiastic and, usually, is not fitted by either temperament or training to anticipate financial requirements with any degree of accuracy. He does not appreciate the importance of doing so and he does not care to co-ordinate production and sales with a carefully analyzed financial program. In the organization referred to it was found that a budget had been prepared, but it was known at the time that it would not be carried to a successful conclusion. The executive head, as stated, was a capable sales manager but not a financier and preferred not to assume such responsibilities nor were they delegated to others until it was almost too late. The difficulties and problems involved were not appreciated and optimism was too much in evidence.

It is the duty of the executive properly to interpret all conditions and apply his experience in such a manner that the unexpected cannot happen. The success of a financial administration depends directly upon his conceptions and interpretations of what is to come. If the executive is wrong, no matter how many last minute remedies are applied, the results will not be satisfactory and may prove disastrous.

Many good business opportunities are allowed to go to waste because those who should conserve and improve them mistake thinking for reasoning; they depend upon "hunches" and impressions and this naturally leads to ineffective or mistaken action and failure. "Be sure you are right, then go ahead" is a good adage to follow if a business is to produce results, make money, and properly expand.

Managing executives must [illegible] anticipate and analyze the conditions which confront them. It is not sufficient to obtain balance sheets and elaborate detailed statements. True, they assist in discovering factory wastes, indicate the productiveness of labor, and show the profits made, but they reflect only that which has gone by.

Shortly after the late war a shipbuilder was startled by the threatening outlook for his apparently successful enterprise. He was satisfied with the present and the past, but had given little thought to the future. The activities of the business were widely distributed. He explained the situation to the directors who thereupon decided on a policy of curtailment of the company activities, and also instituted plans looking toward a radical reduction in overhead. The officers of the company were jealous for their respective departments and objected. It was not until after the resignations of several of the officers had been accepted that the proposed policies were put into effect.

As the next step the directors centered the more important activities of the organization in one man whose duty it was to reorganize and co-ordinate them in such a manner that the foreseen decrease in business would involve a comparatively small loss to the company. This was done and at the same time a strong nucleus was maintained, capable of ready expansion to meet any future requirements of the business. A flexible plan of operation was also developed which co-ordinated with the financial plan, liberal reserves were set aside for maintenance and depreciation, expenditures of all kinds were curtailed, dividends were reduced, and far-sighted plans were laid looking toward a future increase of business and income. The directors had foresight, they appreciated the seriousness of the situation, and their courage and prompt action saved a profitable business.

Briefly stated, capital is apportioned to plant and equipment and working capital. Profits are determined periodically and distribution is made for dividends, reserves, sinking funds, and surplus. It is at these periods that any enlargement of capital permanently invested, together with the setting aside of additional capital for working requirements can best be accomplished.

Raising Additional Capital

If the executives have a proper grasp of the situation, a reserve will be built from income for purposes of healthy expansion. If loans, either long-term or short-term, are considered advisable, they will be made without hesitation but only for definite and clearly understood purposes. If such loans are made for the general development of the enterprise, for the enlargement of the plant, to make certain improvements, or increase profits in certain directions, no diversion should be considered for any reason or purpose. When needs are properly estimated, it is doubtful if the diversion of a loan from its destined purpose will ever even be discussed.

An executive must avoid, at all times, the impression that he is not in a position definitely to state the present and future financial requirements of his business. Many applications for loans have been refused, not because they were not justified, but because the executive was not prepared to present the facts which justified them or even to state clearly his credit requirements.

It may be that short-term loans are not sufficient—that expansion or other capital requirements exist that can only be met by long-term or permanent financing of some kind. Perhaps the sale of common stock is the best means of raising the desired funds. In such case the basis for the issuance of common stock should be probable income. It must always be borne in mind that assured income should be more than enough to cover fixed charges; that anticipated income should be more than enough to cover contingent charges; and that probable income should be more than enough to provide a satisfactory income on the common stock.

As to asset values, the general rule requires that fixed assets should exceed by a safe margin the bonded obligations; that fixed assets plus net current assets should exceed preferred shares, income bonds and other contingent liabilities, and that all assets, fixed and intangible, should exceed fixed and contingent obligations together with common shares outstanding.

Working and Fixed Capital Requirements

The foresighted business man realizes the danger of running short of working capital and provides for it in advance—he does not wait for a post-mortem diagnosis. A statement of the requirements properly arrived at will determine the amount to be retained for this purpose. Unfortunately, many executives postpone any intelligent consideration of their working capital requirements until they are forced to make a confession to their bankers.

No generally applicable rule can be formulated to fix working capital requirements. The more important factors to be considered in arriving at the required amount are the length of period of manufacture, the turnover—otherwise expressed as the ratio of sales to average working assets—the terms of sale and purchase, facilities for conversion of assets into cash, and the seasonal variations in business.

The fixed investment also requires intelligent forethought. When an executive takes the position, as is too often the case, that there is always time to build up the fixed investment, he is doing something which is not regarded by bankers as sound. It should not be necessary to warn him of the dangers of such a course. There should be a definite policy in this connection and it should not be one of postponement.

In determining fixed capital requirements, factors, among others, to keep in mind are the condition of the plant and equipment, improvements or changes to be made therein, the addition of side lines, outside investments, and extensions of the plant.

In determining and carrying out the definite policies of the business a practical budget will prove invaluable both in cases of emergency and to assist in keeping the situation well in hand. A budget will also assist in preventing the serious financial errors and miscalculations that too frequently wreck corporations that would otherwise be successful.

The Problem of Expansion

Good business policy requires the avoidance of any arbitrary course of expansion. All such plans must bear the acid test and must be carefully reasoned out. They must be conservative and all possibility of misunderstanding and misinterpretation must be avoided. And they must embody the guiding principles and policies of the organization.

If the taking over of another organization is under consideration this organization should be investigated in all its phases, and a complete study be made of all available facts, such as location, markets, personnel, etc., that might affect its value and operation. Too much care cannot be exercised in ascertaining its financial history and the advantages of the proposed program, and a complete financial plan should be determined upon before any final decision is reached. If legal rights such as contracts, options, etc., are involved, they should be considered and be settled before and not after, the organization is taken over. Haste should be avoided, as experience has proved that the best results are obtained by the exercise of diplomacy and patience.

Unfortunately, when such an expansion is considered there is too often an overabundance of optimism and emotional enthusiasm. It has not always been proved in practice, although theoretically it appears plausible, that combinations operate more economically than as separate organizations. And this statement is just as true of the combination of organizations that buy and sell to each other as it is of competitive enterprises.

Also, unfortunately, not sufficient thought is given to the guidance of the new organization. Too often men are chosen for tactical reasons or because of ownership or influence, and not because of their enterprise and judgment. The matter is of too great importance to be determined by such considerations. Ability to make a success of the enterprise should take precedence of any other consideration.

Combinations

In considering a merger, very definite preliminary stages must be gone through. As far as is practicable, a general plan should be prepared, not with a view of following it implicitly, but to have in view a definite beginning and a definite objective.

If possible, it would be better if the entire plan were under the direction of one man or a single group of men so that all the details, negotiations, contracts, agreements, etc., may be kept well in hand, as even the best of plans may fail when many personalities are involved. The result of such a condition is many disagreements over trivial matters and these appear in the aggregate as such formidable obstacles that the merger plans are often abandoned.

The important steps to be taken when a combination is under consideration are as follows:

1. A clear conception of the combination and what it involves up to and including its final stages.
2. The development and accumulation of as much detailed information relating to the combination as possible.
3. Formation of a financial plan.

Much can be accomplished before even the preliminary stages of a merger are attempted. If the first material is properly prepared and presented by the corporation or individuals taking the initiative, it will result in a much more favorable impression on the corporations which are invited later to come in, and should also go a long way in securing more desirable terms.

Information Necessary for a Merger

The information necessary when a merger is contemplated includes a concise and comprehensive presentation of the costs of production, cost of advertising and marketing the product, and such other facts as will reflect the accomplishments of the past and the probabilities of the future. It will also be necessary to get a reliable accountant's statement as to the amount of invested capital and the past earning power. The accumulation of this information is essential in molding the combined enterprises into a single profitable, economic organization.

A complete listing of what are considered the advantages of the merger, such as the single ownership, centralized management, etc., of the several corporations to be combined should be carefully prepared. In enumerating the savings to be effected by the combination, the wastes of competition, the wastes in executive and administrative expenses of separate operation and the advantages of standardized operation, can only be estimated, but such estimates are important and where they can be [illegible] to give them weight [illegible] sented in as clear and con[illegible].

There is one definite disadvantage in a merger [illegible] should receive consideration and that is its effect upon the heads of the various corporations to be merged. As the head of an independent company such a person will take a very strong and detailed interest in the success of his corporation, whereas, if he is put, with a number of others, into a position of partial control, acting for a large combination with its multitude of stockholders, a lack of interest is apt to result and the effect on profits be very detrimental. In many cases such a condition has resulted in a complete breakdown of the merger organization. This is due, undoubtedly, to the failure in the early stages of the merger to provide some incentive which would take the place of the former ownership.

From the very inception of a merger it is well to keep in mind the elimination, as far as possible, of fixed charges even though they do not seem cumbersome at the time. It is much easier to avoid these at the beginning than to attempt to make later adjustments with a possible detrimental effect on the credit of the organization.

When seeking to acquire other corporations, their plants should be scrutinized as to the buildings, machinery, costs of production, the availability of the type of labor required, the availability of raw materials, the selling expenses and the nearness of the markets to be served. Assets often exaggerated by the corporations to be merged, because of their anxiety to obtain the highest possible valuation are the intangibles—good-will, patents, etc. Inquiry should be made as to the existence of time contracts and trade agreements and where these exist they should be carefully studied by competent counsel.

It is important that unusual care and diligence be exercised in the discovery and proper presentation of the facts where the organizations to be merged are engaged in the manufacturing of a product of widely fluctuating demand, such, for instance, as the automobile. The possibility of expanding and contracting quickly is then important as the future of the industry is not a certain factor. If it will require considerable time to bring the organization into shape for rapid production, there is a possibility that when it is fully prepared, the output will materially exceed the demand. If the organizations involved have not a large amount of special machinery it might be readily transformed for the manufacture of another product. A condition of this kind would be decidedly favorable, as the bankers of today are not altogether certain as to whether this type of organization justifies development

The Type of Security

The type of security which would be issued in case of a merger is, naturally, dependent upon:

1. The value and cost of the tangible assets to be acquired.
2. The certainty and regularity of future earnings

3. The extent of the market.
4. The extent of the control desired by those interested.

Bonds are usually issued only when future earnings of the merged corporations are likely to be liberal and reasonably constant. Preferred stock is issued when earnings are irregular, but when averaged over a period of years, give a fair margin of profit. If a bond issue can be avoided and stock substituted it is advisable. The bond issue then could always be presented to the public in case of emergency and, meanwhile, a burdensome fixed charge is avoided. The control may be kept through the proper distribution of the common stock.

Another reason for avoiding a bond issue is that in case of a temporary depression it may be impossible to pay the bond interest and in that case bankruptcy would be precipitated with irreparable harm to the future of the organization and its credit.

If it is considered necessary to raise additional money, but a bond issue is inadvisable at the time, purchase money notes may be substituted. In such case the notes should, for purposes of reflecting a conservative financial policy, be carried on the books as a quick liability and not as a funded debt; they should be included in the accounts and notes payable.

The Ten Commandments of Business

Be the business large or small its executives cannot do better than read and remember the ten commandments of business which follow. They are homely but sound. No business conducted in accordance with the principles laid down in them will ever fail because of financial mismanagement.

1. Utilize all possible sources of capital—earning power and credit.
2. Borrow money, but not more than you can pay back.
3. Stimulate healthy expansion, but avoid impairment of capital on outside investments and side lines.
4. Consistently accumulate assets—tangible and intangible.
5. Watch your current assets; they are your protection against emergencies.
6. Use money freely in business, but not for living expenses.
7. Prepare a program that is worth fighting for.
8. Centralize the activities of your business.
9. Use foresight by using a budget.
10. Co-ordinate your financial plan with production and sales.

Safeguarding Machinery to Avoid Accidents

Class Number
658.283 Safety Devices

WE hear a great deal about safety first, and all industries are making efforts to have men exercise greater care to avoid accidents. In addition to this, dangerous parts of machinery must be protected by guards of some sort.

In many cases, however, the guards are of light material and offer little real protection. Many of them are too flimsy to withstand the impact of man's body with any amount of force. Much more care and thought should be used when designing coverings for dangerous parts of machines.

Workmen, as a rule, feel that any guard that is placed on a machine is strong enough to withstand most any load. They will often lean against a guard which may give way and let them fall into the machine, when if there had been no guard they would have kept away from the moving parts.

While as a rule the guards should be heavy and strong, there are certain places where it is thought inadvisable to put on a heavy guard, and in such cases the light guards should be painted a bright red to remind the men to keep away from them as much as possible.

Sheet metal guards are useful where they keep oils, liquids, or small particles from scattering on workmen or machines. Where merely avoiding contact with dangerous wires, moving mechanisms, belts, shafting, and so on, is the only object, the wire mesh guard is suitable. Built up on angles, flat strips, or other small steel shapes, it forms a rigid protection.

Men are often cut or scratched by the rough edges of cheaply made sheet metal guards and while these small wounds are of little consequence in themselves, if properly cared for, they often cause loss of time. Obviously, a guard like this is itself a greater hazard than is the unexposed machine.

Machines where the moving parts cannot be covered because the guards would interfere with the operation of the machine, should be enclosed by railings. In this way, employees other than the men who are running the apparatus are kept away from them.

Safety first posters and bulletins do a great deal of good in reducing accidents, but operators of machinery of a specially dangerous nature should be taught what these dangers are. To keep the dangers in the minds of the men, the posters in each department should, as a rule, deal with the types of machinery to be found there. In addition to this, a printed list of cautions should be posted near each machine.

Any man who is in constant fear of being injured while at work will certainly do less efficient work than one who feels that the employer has done all within his power to make his job a safe one. Proper protection also avoids developing a careless attitude on the part of machine operators. With most sources of danger eliminated, they will be more alert to avoid those which are an adjunct of the occupation.

It is always preferable to impress upon a man the correct way to do a thing rather than to be continually telling him the way it should not be done. Positive instructions are much more easily remembered and carried out than negative ones. Hence directions for operating machines should tell just what to do and the "do not" should be reserved for only the more vital factors of danger.

Linking Accounting to Production

Development of a New German System

By ERNST JUST

Class Number
657.524 Cost Accounting
658:657 Factory Accounting

THE reform of industrial accounting, which has been advocated on the basis of theses developed by the author jointly with Elise Vohl,[1] is progressing favorably in Germany. This reform we are endeavoring to accomplish with the support of prominent authorities interested in the subject.

A system of factory accounting must be dynamic to enable a manager to measure his progress at all points and exercise intelligent control over shop operations. Accounting must "live" with production and reflect its progress immediately and exactly. Merely recording past events is by no means sufficient. As adaptations of the ordinary commercial systems were too inert to be of real ultimate value, the author of this article devised an "energetic" method whose principles and applications he explains.

It is necessary to eliminate imperfections inherent in methods of accounting and cost-finding systems created by commercial bookkeepers. It is also necessary to find a general basis for industrial accounting, a basis that is as suitable for the engineer and manager as for a commercial man. It is necessary likewise to find the law for the organization of factory management in order that "foreman management" may be eliminated from the organization scheme of industrial plants. All of this, according to our views, can be reached by creating for industrial concerns an accounting system of their own instead of an adaptation of commercial bookkeeping with its numerous variations.

Professor Schär calls our system of factory accounting "energetic," because this name expresses in an excellent manner its character. If American management engineers will co-operate with us in an endeavor to place factory accounting on its natural basis, in a few years it will not be necessary to say "energetic factory accounting," as it will be universally known that factory accounting is energetic accounting.

However, just what is energetic factory accounting, and where in the science of accounting energetics can one find a basis for this comparison? Accounting itself is, of course, not energetic. It merely reproduces the actuality, similar to the reflection in a mirror or the shadow of a body. But if a body itself possesses energetic characteristics, then its mirror reflection or shadow may be called by this name. Factory assets are energetic. In their evolution through processes they follow the laws of energetics and therein they differ from commercial assets. The assets of a commercial concern are not attached to any particular place, like, for example, the assets of a public administration. Contrariwise, they must be considered as going through a continuous cycle of performances which result in operations of exchange. Money becomes goods, goods become commercial documents; commercial documents become bankable assets; bankable assets become money, and so on.

Factory assets, however, in addition to the above-mentioned processes, go through certain transformations. These transformations are of such importance and are so much a part, nay, an essence of factory assets, that one cannot understand the substance of factory assets without considering these transformations as a basis of factory management in the organization of works operation and organization of accounting. It is these processes of transformation which take place in accordance with the laws of energetics:

1. Factory assets, no matter of what character, aim to serve production. Before they can do this, however, they must be in a state of expectation. They are at rest. But at each instant they are ready, fully or partially, in one operation or gradually, directly or through their usefulness, to be employed for production. These assets at rest are like potential energy, similar to a reservoir of water or an accumulation of power.
2. From these assets one part goes into production, being consumed by the process: Materials, labor, performances, rights, consumed parts of the plants, and use value of capital. These *consumed assets* are like kinetic energy, similar to water flowing over a weir.
3. But from this consumption or employment new values are created which may be marketable goods. These newly created assets are like regenerated energy. Kinetic energy has again become potential energy.

These considerations have no value if they do not show to the thoughtful organizer that the "shadow of the body," the system of accounting, must follow exactly the same path of development. Nature can be held in bond for a long time, but some day it breaks out; and our observation is that when the true nature of factory accounting is merely shown everyone will recognize it and will draw the proper conclusions.

The purpose of factory accounting is to provide a means of controlling factory assets. It controls available assets and shows the generation of new assets

[1] See *Management Engineering*, January 1923, p. 27, "A New System of German Factory Accounting," by Schär, Schlesinger, and Wallichs.

The factory management should be able, by means of accounting, to justify its stewardship. It is therefore a monstrosity for an industrial concern to employ accounting practice that, in the majority of cases, servilely follows the management of the assets. It is further inadmissible to have a state of things in which the practice of accounting cannot be absolutely relied upon for its correctness, where only a part of the plan is systematic and provided with means of self-control, and where the correctness of the other part, cost accounting, etc., depends solely on the care of the accountant.

Briefly stated, all processes are unnatural and are, therefore, exposed to defects and errors, which do not work in close co-operation with production itself in such manner that there is always an indissoluble connection between the actual changing state of the factory assets themselves and the numerical expression of these variations and changes in the assets of the accounting system. Actuality should flow unfettered over into a numerical representation, while the numerical representation sends its regulating forces likewise unfettered into actuality. Both, namely, actual management of assets and conduct of working operations on the one hand, and the numerically expressed management of assets and conduct of operations on the other, run together automatically in joint accord with each other. It is only thus that nature would determine the relation between factory assets and factory accounting, if it had the job of organizing them, and the problem of the scientific organizer is to imitate what nature would do in its construction.

It is thus that I conceive the problem of the factory organizer, and leading scientists and investigators in contiguous branches of knowledge, such as the science of commerce, technical sciences, science of management, economics, etc., support me in my convictions.

Elements on Which This System is Based

I shall now describe the system of accounting that arises from such a conception of factory assets.

1. *Assets at rest.* For assets at rest we install a bookkeeping method like the usual bookkeeping which has been used so far, except that we eliminate from it all accounts dealing with consumption and production of goods. Furthermore, the structure of accounts is so organized that it may conveniently be brought into accounting relation with:

(*a*) Accounting for consumer assets.
(*b*) Accounting for newly produced assets.

This accounting for assets at rest, which we shall call "asset accounting," exercises control over all inventories, no matter whether these are liquid assets, plants, materials, performances, or rights.

2. *Consumed assets.* For consumed assets we install a system of accounting, which, though pursuing in the main the same aims, is little like the present systems of factory bookkeeping, overhead distribution, cost finding systems, etc. We build up an economic apparatus. On the average there is an accountant for each thousand workmen. His tools are a few sheets of paper, "survey sheets," and a calculating machine. He does not really do his work, as it is done for him by the concern, which is so organized that it gives him all the data in shape suitable for direct addition.

This system of bookkeeping exercises a control with reference to the status of asset values of a non-calculable character which have gone into the industrial operations, and does so by converting them into calculable values. As the problem here is to account for the turnover of assets in the operation (*Betrieb*—by this is meant the entire enterprise) we shall call this part of the bookkeeping "operation accounting."

3. *Newly produced assets.* As regards these, we install a system of bookkeeping which has, in part, the same purpose as the present systems of "self-cost determination," "subsequent calculation," etc. But what these systems endeavor to accomplish by simple accounting, the new system accomplishes by a "double bookkeeping." It does this by crediting the management offices and production plants, which have contributed to the execution of an operation for creation of a product, with their performance, whereas it debits the order, and it does so by the same entry. This bookkeeping exercises control over the remainder:

(*a*) Single expenses.
(*b*) The calculable asset items.
(*c*) The work costs which have been put into calculable shape. At the same time, by a counter entry against the order, it debits production.

As production consists mainly of goods, we shall call this part of accounting "goods accounting." This part of accounting is carried on in a simple manner and even more economically than operation accounting, for whereas in the latter individual forces have to exert their activity, in goods accounting the work goes on one might say automatically. It is in the nature of a by-product of the book entries of inventory records, which in a properly organized concern have to be made anyway. The tool here is the cost sheet based on cost cards.

4. *Total assets.* As regards total assets, we install a general system of accounting which shows a great similarity to the modern trial balance system. The difference is this, however: The trial balance is no longer the usual artificial product, but is merely a compounding of the final figures from the three "accountings." These may be entered in a trial balance book which may be kept as a confidential book. They may, however, also be carried in such manner that operation accounting and goods accounting are combined with assets accounting. This takes place at the end of each month or at any time when accounts are closed. The day after closing the accounts each of the three classified asset accountings goes on in its own way.

The trial balance which is produced by the above-described manipulation as a result of pure calculation is a perfect balance, the same as a yearly balance.

This, in broad lines, is the system of accounting for factory operation which we call the natural system of accounting, because it is our conviction that it corresponds to the natural course of variations in factory assets which it controls. The accounting follows these assets and "lives with them." At the same time it is uniform in the same way that the factory assets are uniform; it is an organism, as the factory assets are an organism; and it is mobile in a manner corresponding to the continuous activity of factory assets, passing from one phase to another and from one state to another.

As regards the work of accountants which corresponds to the components of the system set forth above, for example, bookkeeping and distribution of costing, there prevail, as would appear, many unnatural ways in the structure of modern accounting practice itself. The "cost distribution," "operation bookkeeping," or whatever name may be given to the department which should calculate the overhead cost items of the work, is also entrusted with the duty of distributing the bookkeeping entries among the various offices, shops, etc.

Confusing Assets at Rest with Consumed Assets

At the close of this distribution an "adjustment" is undertaken. As a result, it happens quite frequently that capable concerns, by the perversity of their accounting systems, are made to look as if they were unable to compete with their business rivals. Such a condition is due to the fact that the practitioners of accounting consider themselves bound to distribute all the cost entries, down to the last cent, no matter whether the given concern has actually expended the amounts or not. Bookkeepers confuse assets at rest with consumed assets, and treat them the same way.

In Germany even worse has been known to take place. Factory bookkeepers have considered themselves under obligation not only to distribute down to the last penny all the entries, but they have considered even the entry prices as rigid, as a result of which—in view of the great drop in the value of money—goods have been thrown on the market at excessively low prices, which, unfortunately, entailed a loss to many industrial concerns. Only a short time ago the heads of the accounting departments of larger German plants defended this practice against the present writer. Their argument was: "Where shall we otherwise book the excess values?" With factory bookkeeping being mechanically constructed as it is today, such recording might present difficulties. Any head of the accounting department of an American concern working on the usual cost finding system will confirm this. In the cost finding department the cost entries should be distributed in accordance with the bookkeeping. The difficulty which this creates increases enormously if goods have to be distributed at prices other than those at which they were purchased.

For all of these difficulties and doubts we have a simple solution, providing we follow the natural principle of accounting between the various members of the accountancy organism; no one of them bothers any other as to the conditions under which the other has to work, and each performs its own duty solely. Operation accounting receives from asset accounting what the concern consumes. It credits asset accounting with that much, and is, in turn, debited with so much by asset [illegible] from asset [illegible] credits asset [illegible] that much by asset [illegible]

The same takes [illegible] and goods accounting. Wh[illegible] is work costs. These are [illegible] counting to the extent to [illegible] them over, and operation accounting [illegible] goods accounting with the same amount.

If, during the intervening period, materials, performances, rights, depreciation of machinery, use value of capital, etc., increase in value hundreds or thousands of times because of the depreciation of money, it is unfair to demand from a given account that it give away its output at the same price at which it has acquired that output, which means that it should accept bad money for good money at the same rate. In this case an appropriate price has to be determined in a manner similar to that between seller and buyer.

The principle of computed or appropriate price may be adopted and followed when the system of accounting has components of equal standing. A period must be set, also, when these components are to be balanced up with the general organism, that is, in the accounting of the total assets—the day of closing the books.

The relations and performances of the single phases of assets—which are represented by the individual components of the system of accounting—are valued on the basis of equality. Without any trouble one may obtain either the excesses or deficits in values.

Proper Control Impossible With "Static" Processes

We have asserted, together with Professor Schmalenbach of Cologne, that the usual accounting for results installed in accordance with "static" processes, that is, processes in which the entries in bookkeeping are simply calculated out, is apt to give false information. Proper control of conditions and results can be attained only when, by using the processes indicated above, one compares *actual* expenditures at *appropriate* prices with results obtained.

To focus on a single point the consideration which I have tried to set forth above, I can find no better way to express the idea than has been already used by Professor Schär, as stated at the beginning of this article. He says:

> The factory accounting of the future must be energetic; that is, it must get off of its high seat, and must get rid of its rigidity. It must follow the changes in the assets, to whose living control it is devoted, and do it contemporaneously. And, moreover, it should go through all the transformations that the assets have to undergo in their life.

The man who builds up a system of factory accounting on these foundations, arrives at a system that is not far removed from our own. Therefore, it is foolish to give our system a special name; it is merely the *natural* system of accounting which, once discovered, will not be forsaken. Since it has not yet been universally accepted, however, we shall call it "energetic factory accounting."

THE EDITORS' PAGE

Relativity and Industrial Misunderstanding

WE can thank Einstein and his abstruse theory of relativity for one practical idea. He has shown us vividly a reason for misunderstandings among men. His message should make us more tolerant of the other fellow's point of view and keep us more ready to concede his honesty of purpose, although we cannot understand why he believes as he does.

The coal parley draws our attention to this same thought. One of the commissioners in the course of the negotiations between the miners and operators, after listening to the representatives of each side of the controversy explain their own letter, and put an interpretation upon the letter from the other side, summed up the resulting confusion in these words:

> Neither the operators nor the miners understand the language of the other, and the commission does not understand either.

To be sure, much of this non-understandable language was the "language of negotiation." But a similar confusion often arises in the discussions and conferences which lack the heat and combat of the coal parleys.

Now for Einstein's help. He tells us that everything is relative and nothing is absolute. That different observers may view the same happening and see a different course of events. One of the most striking illustrations of this particular fact is:

Let three men visit an amusement park like Coney Island. One of them goes up for a sail in an airplane, another steps upon a large revolving disk, the third stands on the ground near the second. As the second man is being whirled around the first flies directly overhead. A half-hour later all three gather around a table and describe the airplane flight. The one who stood on the ground declared that the airplane made a perfectly straight flight, passing directly over the revolving disk. The man who was whirled around declared that this was not so, that the plane made a series of interwoven horizontal loops. The man who actually flew declared that both of the others were wrong and the aviator's course went up and then down in a big curve which was convex upward.

Note the complete difference of each observation from the other two. Yet each man described accurately what he actually saw. The differences in their observations come entirely from different points of view.

So it is always wise to try and see the point from which the other man is observing; or if a number are in conference to try to reach a common point of view in order that there may be a meeting of minds.

In industrial operation this necessity is particularly pressing where it is recognized that employee and employer are standing in different places and that the public occupies yet a third. Only by shifts and changes which will present everything from a common observation point, can we hope to bring about agreement and harmonious action.

Too often we have believed that all that was needed was to get everybody around the same table. This is not enough. It is necessary to get everybody on the same side of the same table.

Measuring the Economies Achieved by Management

ENGINEERING formulas, especially when empirical, usually consist of a large number of terms or factors determined from careful study of the many elements affecting the subject under investigation. Likewise, management formulas, which will of necessity be developed if the art is to grow to a science, will probably take in many factors and will rarely reduce to very simple form. All such mathematical expressions must go through the process of evolution by experience data, for it will be a long time before the laws of management are discovered and the formulas can be derived with accuracy.

The formulas now under consideration for computing the economies of labor-saving equipment, proposed by a committee whose report is outlined in this issue, illustrate the logical process in working out expressions of this kind. While improvements in industrial processes and methods of doing work have appeared in increasing number, no adequate means existed to measure their economies. From the management standpoint such a measure was a necessity. Of course, no labor-saving device is installed without the definite prospect of obtaining worth-while advantages, usually of a monetary nature. However, the calculations have taken the form of balancing operating expenses and comparing output. Usually the new scheme has been charged with the burden of interest, taxes, obsolescence, and other fixed expenses, but has not been credited with the monetary value of labor saved by improved methods.

The committee of the American Society of Mechanical Engineers, Materials Handling Division, has been studying the question. This committee points out that the cost of labor *used* establishes a unit value which must be applied to measure the value of labor *saved* by a substitute process of greater economy. For simplicity, this value need be applied only to the *difference* between the amounts of labor required under each of the two methods, plus overhead burden, or an equivalent.

A second consideration suggested is that, when comparing the economies of the two methods, increased production must be credited with a higher value than that attached to normal production.

Upon these two premises the committee has built its formulas, so that in place of the customary mere estimate of the advantages of substituting machinery for hand labor, or an improved machine for a cruder one, an actual mathematical measure can be used. These formulas are experiential, but as they include all the factors which can be directly applied to determine the relative economies in question, they undoubtedly will give satisfactory service.

Thus, one more of the many branches in which management has a deciding and critical influence has yielded a means of evaluating results. The effect of changes can be determined before the committing steps are taken. Similar possibilities exist in all of the fields where the responsibilities of management are exercised.

The sooner the work of investigation is undertaken and concluded the better and safer will be the control of industry. Perhaps the real measure of management itself, as a whole, in a particular business or industry awaits the evolution of measures of its detailed application to many individual features such as the installation of labor-saving equipment.

Auditing Executive Activities

IN the larger corporations an audit of accounts—annually or more often—is a matter of routine. Not only is the accuracy of the accounting results verified, but the auditor passes upon the adequacy of the accounts themselves, interprets them for the benefit of the executive, and keeps a watchful eye for anything irregular, defective, or objectionable, either in the accounts or outside them as far as ascertainable from the books or records at his disposal.

Elsewhere in this number of MANAGEMENT AND ADMINISTRATION, Mr. Waldron discusses the wisdom of extending this systematic audit beyond the accounting records so as to include in its survey both management and methods in every part of the establishment. If it is good to have an expert check upon the accuracy and effectiveness of the accounting records and procedure, he argues that it should be equally good to have an expert check upon the adequacy and effectiveness of the management and methods throughout the establishment.

In another column Mr. Darnell, discussing wage-incentive plans, describes the detailed procedure of just such an "audit" or "observation" in connection with machine and tool operations, and points out the very valuable results secured. Naturally the trained observer, expert himself in the operation observed, can see faults and deficiencies and suggest improvements that those who are in daily contact with the operation do not perceive. Is it not reasonable to suppose that a similar audit or observation properly conducted and including every industrial activity from the purchase of raw material to the collection of accounts for goods sold, and extending from the boy in the front office to the executive at the head of the enterprise, would be equally beneficial?

Of all the operations of an industrial enterprise, management is the most important and, at the same time, the most difficult to measure correctly. In a way, of course, the audit of any activity in the enterprise is an audit of executive [illegible] up in Taylor's "Scientific Management" [illegible] more nor less than [illegible] men to do, and then seeing that they [illegible] the best and cheapest way." If the observation of the machine operation shows that the machine used is not the best, all things considered, for the [illegible] employed, or that the workman is not doing his part of the operation "in the best and cheapest way," it is an indictment of management, and the same thing is true for any other performance in the whole range of the concern's activity that is not done "in the best and cheapest way."

A direct audit of management would not, however, be carried so far. It would include an observation of: first, the executive plans and policies, and second, the organization control through which these plans and policies are put into effect. The audit of organization control is obviously simpler than an audit of plans and policies, although it, too, has its difficulties. Who shall say, for instance, whether the executive transmits his instructions to those who assist him, and supervises their performance in the most effective way, and that these assistants, in their turn, transmit his instructions to their subordinates and supervise these subordinates in such manner as to produce the best results?

When, however, we come to the audit of policies the difficulties are still greater. It is but seldom that the executive individual, or body, will adopt plans and policies that are openly ineffective, inadequate, or injurious. These plans and policies must, then, for the most part be judged by results, and the policy audit can be little more than a balance sheet audit—a judgment on the basis of general results. If these are good, the plans and policies are good; if these are bad, the plans and policies are bad. As in the case of the balance sheet audit, the discovery is made after the event—that is when sufficient results have accrued to show either the excellence or deficiencies of the plans and policies under observation.

Regardless, however, of the difficulties and limitations of an audit of management no one would seriously question its value if properly conducted. Initiative is not common; sustained initiative is rare—even among executives. It is so much easier to follow precedent—to tread the beaten path—to travel in the rut. Even then the going is difficult, and instead of seeking new and perhaps better ways, the executive bends every energy to getting along as well as he can "in the good old way." This tendency is so strong that few executives escape its influence entirely, and anything that will wake them up—that will point out new and better ways is good—very good.

The audit of management will do this. Such an audit must, though, as intimated, be properly conducted. The experts who make it must come from outside the establishment under observation so that their opinions may be unbiased. They must be of high standing so that their opinions may command respect. And, finally, the executive himself whose actions are under observation must be of such broad and open mind that the findings of the audit will be fairly judged, and as far as practicable, be put into effect.

THE READERS' PAGE

Industrial Standards

Editors of MANAGEMENT AND ADMINISTRATION:

In noting the listing of Industrial Standards of the United States as given in the July and August issues of MANAGEMENT AND ADMINISTRATION we note on page 257 of the July number, under the heading "Specification for and Measurement of Standard Sieves," that reference is made to Circular 39 of this Bureau. Possibly some of your readers would appreciate knowing that the revised specifications for sieves are given in our Letter Circular 74 (L. C. 74) entitled "Standard Specifications for Sieves."

Your readers may also be interested in "Notes on the Use of Standardized Steel Tapes," which contain "Specifications for Standard Steel Tape."

GEORGE K. BURGESS.
Director, Bureau of Standards, United States Department of Commerce

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Accountants as Forecasters

Mr. Stephens' suggestion, set forth in the following letter, that the professional accountant should advise his clients "of the probable course of their business and their trade" is most interesting. Equally interesting is the comment of the next letter written by Mr. Hurdman from the viewpoint of the professional accountant:

Editors of MANAGEMENT AND ADMINISTRATION:

Twenty-five years ago the average business man thought of engaging an accountant only if he wished to assure himself of the honesty of his employees. Many a contract was the result of some defalcation and the necessity of determining the exact amount of loss for settlement purposes.

The corporate development of this country which started with the inauguration of President McKinley, or, more correctly, with the declaration of war with Spain in 1898, did much to change the work of the accountant.

Thousands of incorporations took place, and many consolidations, requiring correct balance sheets as of certain dates. Banks, the Stock Exchange, commercial paper houses, and finally, the federal reserve bank demanded accurate business statements, certified to by accountants.

Then 1913 brought the federal income tax; 1914, the war, and the immense increase in the expenditures of our federal government gave rise to the various tax laws, which added to the sphere of the accountant. I dare say that at least one-half of all accountants' contracts made during the last five years were caused by the Internal Revenue Department making an additional assessment, requesting analysis, correction, or additional information, in regard to income tax returns.

The average business man has no adequate conception of this tax problem. In fact, he is actually afraid to tackle the job, and perhaps it is for the best. It is due to this fact that business has been permitted to develop the tax accountant, specifically trained to handle only tax problems.

In starting with this short outline of the development of the accounting profession, I have reasons which will be understood later. The last few years have administered severe punishment to business, but the business unprepared for a real test, the business insufficiently organized to watch the current trend, and the business working without plans, and without machinery necessary for their execution, has had to withstand much the heavier pressure.

It has been my good fortune during this period to observe closely from the viewpoint of the professional accountant, the necessities and requirements of a manufacturing business. I have formed definite conclusions, and it is these I want to discuss with your readers.

The first definite requirement, in my judgment, is that every business man should have a clear, definite, idea of his daily standing. Not very many items—about ten—will be sufficient. He should read it somewhat in the way that most men read their morning newspaper. There should be headlines on this daily statement showing the Total Cash on Hand, Total Accounts Receivable, Total Accounts Payable, Total Bills Payable, Total Incoming Orders, Total Shipments—the last two, preferably in a comparative form, to show whether progress is being made against the prior year. In addition to this, the estimate of the Sales and Expenditures of the next month. These ten items, if watched carefully every day, will give any executive a mighty good idea of his daily standing. In smaller type, more detail may be added, so that if he cares to see more than the headlines of any particular item, he may do so.

The second requirement is "budgeting"—the preparing in black and white of business plans; setting definite goals; then bending every energy to reach them. To these two requirements I wish to add a third, which in my opinion is most important. It is the determining of an adequate inventory; of when to unload; when to carry a well-balanced inventory, and when deliberately to create a large one. This, to me, is the most profitable field of the management of any business.

I maintain that accountancy, as a profession, is lacking vision by not tackling this problem. It is very well to furnish balance sheets which form the basis of loans; to install cost systems which accurately determine costs; to take care of tax problems. Accountancy, as a profession, must sooner or later add to its reports the new service of forecasts—advice to clients of the probable course of their business and their trade in the next business period. By so doing, the accountant will add to the profit of the client's business and abandon the present plan of being satisfied to write past history only. True, it will take considerable vision and no little real work. It will take courage to let precedent be precedent and do this necessary thing. All real, big business is doing this today. Standard Oil and United States Steel have departments costing a quarter of a million dollars a year, which do nothing but forecast and plan the next year's production and sales.

The only way the average business man can be given the benefit of such a service is by the accounting profession rendering it to him, and the difficulties are by no means insurmountable.

Let every accountant become a thorough student of statistics. Babson's, so far, seems to me to be the best available. Let him read the financial barometers of each day. Let him study the trend of the interest rate, and the price of money. Let him read and thoroughly digest the federal reserve bank reviews, the Clearing House statements, both of New York City and his section. Let him watch United States Steel unfilled order reports. Let him watch the carloading statement of the American Railway Association. Let him carefully watch the pig iron production and the wool and cotton consumption reports, and the government crop reports.

Let Accounting Societies take up this subject as very properly belonging to them and you will soon have an accountant eager to establish statistics for each client whom he serves, which will become the vital factor in determining the size of his inventory.

C. H. STEPHENS,
Shur-on Optical Company, Inc.

Editors of MANAGEMENT AND ADMINISTRATION:

I am glad to comply with your request for my reaction on the letter of Mr. C. H. Stephens. It is true that the field of accountancy has opened up widely in the past decade and yet that field seems only to have been touched. One can foresee, with reasonable accuracy, future activities for the accountant in the field of business that would not have been admitted as a possibility 10 years ago.

The training which the accountant receives in practice and in the technical schools available to him for study furnishes him with an equipment which should be of distinct advantage to business, provided this equipment is employed intelligently.

As in law, medicine, and any of the other professions, comparatively few accountants will acquire the ability to perform other than the routine duties of the accountant, such as the audit, system work, and preparation of formal reports. However, as the profession advances in knowledge and experience it is conceivable that many problems, not now ordinarily assigned to it, will develop upon the practicing accountant for solution.

In this country, until very recently, one seldom heard of the appoint[illegible] or trustee in ban[illegible] to conceive of a person [illegible] administer [illegible] affairs of a corporation [illegible] difficulties than the accountant who for years has studied business from every angle, who is versed in sound economics and the first principle of whose profession is that he shall consider matters laid before him impartially and with the single view of determining the facts.

More and more business men are relying upon the accountant for counsel in determining the fundamental principles underlying their business. Heretofore, the business man considered that no one coming in from the outside could tell him anything worth knowing about his particular business that he did not already know. But it is now generally admitted that the thoroughly qualified accountant can be of considerable value to executives in advising on matters of policy, finance and the proper relation of component parts of the business to the whole structure. He can also be of assistance in the preparation of budgets based upon past experience and anticipated business.

There is some doubt as to whether or not the accountant's field will ever embrace that of forecaster of future events. It may be true that the accountant with his knowledge of figures and their use is the logical person to develop data with reference to business cycles and the like, yet one is not ready to admit that the accountant should forsake the firm ground of fact for one of theory and prophecy.

For the present at least, the accountant should fortify himself with all of the data bearing upon business conditions, such as the reports of the federal reserve banks, the clearing house, foreign trade, the steel industry and other agencies, for the purpose of forming conclusions with regard to economic conditions and for comparisons with actual conditions surrounding the various problems before him.

He might very well leave to the statistician or specially developed organization the responsibility for forecasting periods of depression and prosperity, inasmuch as the ability to do so with any degree of success must necessarily depend upon the accumulation of data from varied sources in many parts of the world.

Excellent studies have been made by the Robert Morris Associates, an organization composed of bank credit men in this country, in developing statistics covering ratios of merchandise, accounts receivable, cash, etc., to other parts of the statements submitted by borrowers. These studies have been very interesting in disclosing upward and downward tendencies in the progress of the various concerns so analyzed.

As previously stated, there is no one better fitted than the accountant to conduct research along these lines. By so doing he will not only increase his own sphere of usefulness to his client, but the knowledge gained properly applied should be of inestimable value to himself as an accountant and to the business interests which he serves.

FREDERICK H. HURDMAN,
Of Hurdman and Cranstoun
Certified Public Accountants

An Aid to Large-Scale Development

ALTHOUGH many expressions of approval and appreciation of the enlarged magazine are being received, the editors are particularly anxious not to use too much of the space of this department, which is essentially an open forum, in the printing of them. However, the following letter is so discriminating that the reproduction of it seems amply justified.

Editors of MANAGEMENT AND ADMINISTRATION:

The physical dissimilarity between the products of a bank and those of an industrial enterprise does not alter the fact that the two institutions have many fundamental problems in common. Among these, for example, are the selection, training, advancement, and compensation of the personnel; the development of a proper type of organization; the choice of appropriate operating methods. And both institutions must, of course, maintain adequate control over production costs in order to insure a net profit.

On the cover of your magazine appears the phrase, "Devoted to Industrial Enterprise." The writer is inclined to doubt that the range of the magazine is actually limited to the extent indicated by this phrase. Reference is made particularly to the value of the contents as applied to the management and operation of a large banking institution.

The writer can recall several instances where local adaptation has been made of ideas which appeared in MANAGEMENT AND ADMINISTRATION articles that were written from the industrial point of view. Portions of the Knoeppel series, dealing with the co-ordination of purchasing, production, selling and financing; the value of planning, as illustrated by the "Leviathan" articles; and the description of the use of reports and charts by a chief executive, are examples.

It is the writer's personal belief that a broader application is possible, along the lines indicated, of the acknowledged value of MANAGEMENT AND ADMINISTRATION, as an aid to large-scale business development.

H. S. KIRBY,
Auditor, Irving Bank-Columbia Trust Company.

The Philadelphia Sesqui-Centennial

Editors of MANAGEMENT AND ADMINISTRATION:

I am very strong for the project you are suggesting to the directors of the Sesqui-Centennial.

Permit me to make the suggestion that you add a phrase or sentence, or perhaps more, to express the notion that it is in a sense the birth of the profession of business management that we are interested in.

I think this idea of a professional attitude among business managers should be repeated and repeated at every opportunity.

Allow me to compliment you on the idea. I hope it will be pressed through.

HENRY S. DENNISON,
President, Dennison Manufacturing Company

Old and New Production Methods

THIS refreshing communication is from the Sales Manager of the Bristol Door and Lumber Company, of Bristol, Tennessee:

Editors of MANAGEMENT AND ADMINISTRATION:

In visiting a large packing plant the writer was surprised to see a number of men working in a room where the atmosphere was suggestive of anything but roses and violets. When asked how they could possibly endure it, one of the men replied: "We are used to it. We don't notice the smell at all, unless some visitor calls attention to it."

The manufacturing game is often like that. Those inside, closest to the workings of the concern, do not realize that their methods are obsolete until some outsider comes along and calls their attention to the real conditions. Methods become stagnant, motionless, inactive. The same ones are used today as were used yesterday and the day before, and years before that. All the executives have become reconciled to this condition, running along smoothly in a well-oiled groove. Their only salvation is to be awakened, by some observing outsider, from their pleasant dream.

Competition was never so keen as it is today. In order to meet it we must produce efficiently and economically. We must buy raw material carefully and distribute the finished product at the lowest possible sales cost. In order to keep in the running and compete successfully with our neighbors we must know all our costs, absolutely. Slipshod cost-keeping can bring but one result—failure.

The World War brought about very rapid progress in manufacturing efficiency. The high-speed machines of today must be presided over by high-speed men, who have learned from experience as teachers, and are open to suggestions from anybody, from the lowest position to the highest. Incidentally, one of the most profitable suggestions I ever received in my business was from a 16-year-old boy. Of course it needed adaptation, but nevertheless the boy had the big idea.

Owners and managers whose plants are showing a satisfactory profit are very prone to sit back and congratulate themselves that their enterprises are being operated with the maximum efficiency. But the chances are that many of them are operating along the same lines that have been followed for years, while the world has traveled fast and far in the meantime.

Here is a suggestion to industrial executives. Take a few strolls through your plants with these ideas in mind. View the proceedings, through all the various processes of manufacture, as through the eyes of a disinterested visitor. If you look carefully for leaks, I can almost guarantee that you will find them, because they are in practically every plant and there is no particular reason why your plant should be an exception to the general rule. Then see if you cannot, in the light of your discoveries, apply some new and better methods of production that will enable your concern to keep up with the procession, if indeed it does not lead it.

C. T. NICHOLS.

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

PREPARED BY LEWIS H. HANEY

Director, New York University Bureau of Business Research

Barometer of Industry and Trade

Greater Stability: Irregular Improvement Beginning

On the whole, the reading of the barometer for August and September is more favorable than any which has been possible since February. It seems probable that improvement in business and firmer prices are in prospect for the not distant future. September will tell the story. If the trend which is indicated by the August reading is continued during September, it will be possible for the first time in eight months to make a definitely favorable forecast.

The salient point in Fig. 1 is the slight but material upturn in the main forecasting line, $\frac{P}{V}$ line. This is the first appreciable reversal in the trend of this line since December 1922. The downward trend has been more gradual than in 1920 and the line has not fallen below the normal area, both of which facts have indicated that no violent recession in business has been in prospect. Nevertheless the $\frac{P}{V}$ line has forecast, as usual by about six months, a real setback in business. Now its slight upturn holds out hope that within a few months business will be on the upgrade.

The data shown on the following pages clearly demonstrate that July and August witnessed a considerable recession in business and one which was much greater than normal for the season. Production in basic industries, after eliminating seasonal variation, declined. The trend of employment was downward. The index of bank debits to individual accounts fell back nearly to the 1922 level. Mail order sales declined in August and fell off more than usual in that month, probably indicating diminished purchasing power among western farmers. There was a large decrease in the unfilled orders of the United States Steel Corporation, and the rate of production of pig iron was very considerably reduced. Forward buying of iron and steel has been disappointing. Prices reached the bottom in August, and our six-commodity price index, which is an average for the month, fell below the level of October 1922. New business enterprises reached a very low level in August, while failures increased from the preceding month and were considerably in excess of normal.

Perhaps one of the chief indications to be stressed in emphasizing the decline is the movement of building activity. The figures compiled by the F. W. Dodge Company show that contracts awarded fell off 5 per cent in August as compared with July and were 15 per cent less than in August 1922. When

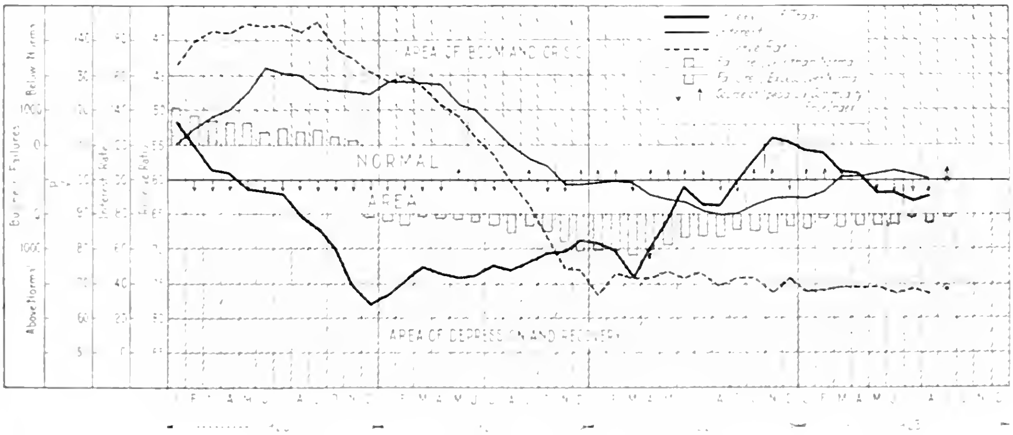


FIG. 1. THE BAROMETER OF INDUSTRY AND TRADE

Areas in which curves lie indicate that business is good, normal or poor, respectively. Curve P/V shows the trend of commodity demand, and is the ratio between Bradstreet's index of wholesale prices and physical volume of trade (carloadings times tons per car), based on 1912 as the normal year. A rise in the curve indicates increasing demand, and vice versa. Interest rate curve has been corrected for seasonal variation, and index number 100 equals 5 per cent. Federal reserve ratio of cash reserves to note and deposit liabilities is inverted to harmonize its indications with the rest of the curves, and is corrected for seasonal variation on revised basis from January 1923 on. Business failure bars are based on Dun's reports, and "normal" equals the trend for 40 years. Six-Commodity price index based on N. Y. U. Bureau special investigation. September 1923 data shown is probable trend.

it is remembered that the spring boom was largely built upon building activity, the significance of this trend is apparent.

Still another indication of the decline is furnished by the movement of imports. The import statistics are usually an excellent indication of the trend of business and they have shown a steady decline for a number of months.

One must conclude that a recession in business which is as considerable and general as that indicated, cannot be reversed in an instant. It will take a process of stabilization and that will require time. Nevertheless, it now seems that August will prove to have been the bottom of the slump—though it must be admitted that the first two weeks of September failed to show as much progress as many had expected. The reasons for this conclusion are as follows:

About the middle of August there was a change in the price trend. The index of wholesale commodity prices, which had been moving downward, registered small gains on September 1, and the Fisher weekly index shows that this change came about the middle of the month. It has been apparent for some time that the number of price increases has been gaining on the decreases. The September level of basic commodity prices will be higher than the August level. This is the most significant factor in the situation, for as soon as buyers are convinced that no further general declines in prices are likely they will begin to place orders, and business can go ahead.

Another indication is that production has been checked. As already stated the index of production in basic commodities shows an unusually great decline.

Still another indication is that the money rates do not indicate further depression, but rather the beginning of fair seasonal trade activity. They do not indicate any great activity, but do indicate a slight improvement.

We now have clear evidence that the wage advances which were so disturbing, particularly in the building industry, have been checked with the passing of the recent labor shortage. Business failures will probably decrease in September.

Conclusion. It seems safe to say that a condition of relative stability in industry is at hand. Of course, allowance will have to be made during several years for the basic readjustments which will be required to restore normal conditions in domestic and international trade. Price and wage maladjustments still exist. Nevertheless conditions are more nearly normal both at home and abroad; and two of the curves in our barometer lie near the center of the "normal area." The outlook is for moderately rising prices, though with considerable irregularity among different commodities, and firm interest rates seem likely this fall.

A small upturn in our $\frac{P}{V}$ line increases the probability of real business improvement early in 1924, this improvement to be based on firm prices and more moderate production. Between now and that time not much more is to be hoped for than an approximation of the usual seasonal gains in business. A number of industries are in bad shape (e.g., petroleum and hides and leather) and others are slow in feeling the fall quickening of trade (e.g., iron and steel). Wages are still relatively high compared with wholesale prices, while it seems probable that the purchasing power of the average consumer is on the decline. Accordingly industry will do well to hold its own during the next two or three months.

As evidence grows that the downward trend of prices has been changed, buyers may consider placing orders and conservatively extending their commitments.

The stock market shows little as yet, with the volume of sales small on rises; but if the trend of business continues as forecast it is rather likely that an upturn in security prices may begin some time in October.

A study of the details of the barometer curve yields the following results:

(1) The six-commodity price index, while it averaged lower in August than in July, shows the end of the decline; since it fell only from 118 to 117.5. Present indications are that it will rise in September. As the six commodities chosen are those which generally reflect promptly the industrial trend, this change is significant.

(2) The interest rate on the best commercial paper rose toward the end of August from 5 to $5\frac{1}{4}$ per cent. At present the outlook is for further increase to $5\frac{1}{2}$ per cent before the end of September. This increase is slightly less than the normal seasonal variation and consequently the interest curve shows a small decline. The fact that it is so nearly normal, however, is a favorable indication.

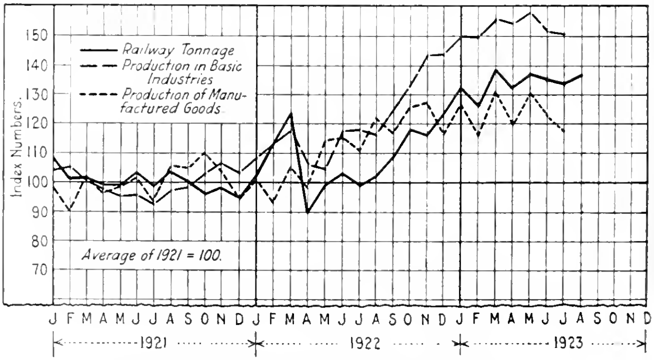
(3) The increase in August failures made the failure bar in the barometer show a greater excess over normal and indicated unsettlement in business. September will probably show a considerably smaller number of business failures and a resumption of the trend toward normal in this respect.

(4) The $\frac{P}{V}$ line rose from 94.4 to 95.3 in August, indicating an improvement in the intensity in demand for commodities and a more nearly normal relation between demand and supply.

Production and Stocks of Commodities

Production Reduced But Stocks Accumulate

The movement of stocks of important commodities, as shown in Table 1, indicates an accumulation in 5 of the 7 industries. In the case of gasoline (where the figures are adjusted for seasonal variation) and pneumatic tires, the situation is bad. Stocks of zinc and paper are gaining faster than usual at this season. Stocks of cattle leather, while they are increasing but slowly, are too large. The decrease in raw sugar and cotton-seed oil is partly seasonal.



Sources, Federal Reserve Board, N. Y. U. Bureau of Business Research

FIG. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

Railway tonnage and basic industries production corrected for seasonal variation, and the latter also for normal growth.

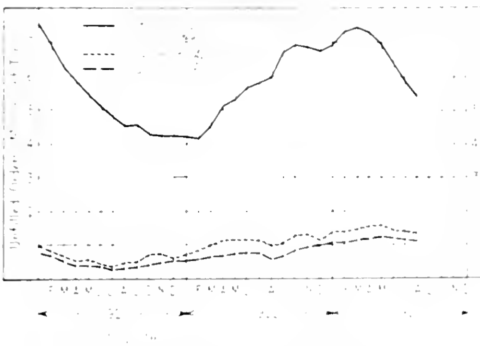


Fig. 2. [illegible]

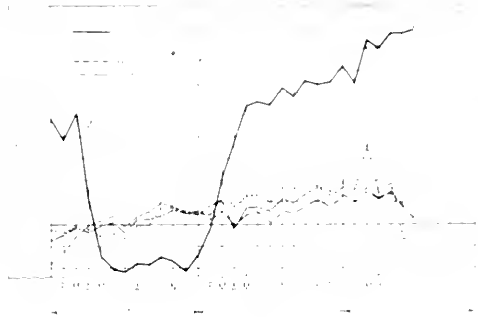


Fig. 3. [illegible]

Production and Railway Tonnage

Production in basic industries. Fig. 2 shows that the indexes of production registered a recession in July which was considerably greater than usual for that month. The index of production in basic industries prepared by the Federal Reserve Board continued the downward trend of June, though the July decline of 0.8 per cent was smaller than in the preceding month. The index of production in manufacturing industries fell off more sharply than the other two, but that is largely because it is not corrected for seasonal variation.

Railway tonnage. Our July index of railway tonnage, which also eliminates seasonal variation, declined 1.5 per cent. The railway tonnage figure is the only one that can be brought down through August. It indicates an upturn in that month, following the July decline. Railway tonnage in August 1923 was 36 per cent greater than in 1922.

Conclusion. While production has been declining, it continued during July and August at a much higher level than last year, and there is reason to believe that not much further decline is in prospect in the near future. The decrease in the index of production in basic industries at the same time that railway tonnage has been maintained, may be interpreted as showing a tendency to relieve an overaccumulation of production, since it means that transportation has gained on the activity of factories, mines, etc. The two curves, however, are still out of line.

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
Index Numbers. Average for 1921 = 100

Month and Year	Gasoline*	Leather Cattle	Zinc	Newsprint Paper	Automobile Tires	Raw Sugar	Cotton-seed Oil
	100 = 630,757,000 gals	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,000 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs
Jan 1921	89	100.7	72.2	82.5	126.2	55.9	107.4
Feb	93	102.5	98.4	108.0	121.9	74.5	124.1
Mar	92	102.1	101.1	120.5	119.0	86.1	140.9
Apr	92	102.5	104.9	123.3	105.3	76.8	144.2
May	104	100.8	103.1	117.0	103.7	164.7	146.0
June	103	104.4	108.4	104.0	102.0	196.5	130.8
July	109	100.5	116.4	88.7	95.2	170.0	117.3
Aug	108	99.5	119.7	85.0	89.2	106.1	89.4
Sept	109	99.5	112.1	90.4	90.2	97.4	63.0
Oct.	102	96.4	105.1	100.8	76.6	93.8	34.2
Nov	102	95.9	91.7	76.7	81.2	48.9	46.0
Dec	103	97.2	86.8	77.1	89.6	48.9	74.2
Jan 1922	110	98.5	78.5	79.8	84.7	27.5	101.2
Feb	110	99.0	85.1	88.5	95.6	46.7	107.7
Mar.	110	100.7	83.1	92.7	107.5	116.1	115.3
Apr	110	95.4	78.1	93.9	118.8	202.2	117.3
May	111	101.5	67.0	82.9	125.2	197.8	118.7
June	114	101.6	52.3	82.6	126.6	179.5	99.8
July	123	98.3	38.3	77.9	115.5	166.8	82.7
Aug	133	97.4	37.1	70.5	110.8	208.5	64.4
Sept.	146	91.5	28.0	66.3	106.1	148.0	47.7
Oct.	161	90.2	24.4	62.7	105.7	99.0	20.8
Nov.	160	87.7	23.4	65.8	107.3	49.6	22.6
Dec.	156	85.9	25.3	65.4	113.8	28.2	30.8
Jan. 1923	156	85.3	23.6	64.0	105.4	15.8	77.0
Feb.	154	84.0	21.5	76.7	107.6	40.2	77.1
Mar.	162	82.6	14.1	77.3	119.7	73.4	88.6
Apr.	164	81.6	13.0	67.2	129.9	184.3	93.9
May	173	81.4	11.6	62.9	139.3	211.1	92.3
June	174	82.1	16.9	60.5	139.6	166.6	87.2
July	185	82.8	22.2	65.0	161.4	151.0	77.1
Aug	....	83.6	27.5	84.0		128.8	74.0
Sept			34.4			96.6	

* Last of month; adjusted for seasonal variation

Iron and Steel Production

The month of August shows a [illegible] considerable slackening in the iron and steel industry, all of which cannot be attributed to seasonal dullness. Production facts as shown in Fig. 3 are as follows:

Production. The average daily production of pig iron fell to 110,816 tons, as against 118,656 in July, a drop of 6.5 per cent. Steel ingot production for August totaled 3,508,347 tons, an increase of 4.7 per cent over July; but the average daily output, which is more significant, dropped to 136,276 tons from 140,570 in July. There were 27 working days in August as against only 25 in July.

Unfilled Orders. The unfilled orders of the United States Steel Corporation continued to decrease in August. At the end of the month they amounted to 5,414,663 tons, which figure constitutes a decrease of 496,100 tons, or about 8.1 per cent from the July total, and is a somewhat greater reduction than had been anticipated. The August tonnage is the smallest of any month since May 1922, when it was 5,254,228.

Price. The price situation remains practically unchanged, but pig iron is reported to be weaker.

Conclusion. The curves of iron and steel for August show a continuation of the minor reaction which has been progressing for the past three or four months. While the Japanese disaster may have a slight quickening influence on orders in the near future, the outlook at present is not promising. At the middle of September, no marked improvement in orders had occurred. September will furnish a severe test of the steel industry.

Production in Important Industries

Copper and Paper. The most notable facts shown in Fig. 4, are the continuation both of the recent high production of copper and of the low production of paper (all grades).

Wool and Cotton Consumption decreased for two consecutive months beginning with June and in July was only slightly above the averages for 1921. Curtailment has been pretty general among cotton mills. On account of the short crop, raw cotton has risen so much that the mills have not bought freely. Cloth prices have not kept pace with cotton, and the mills have been in a predicament. August cotton consumption increased but is lower than any month since April 1922.

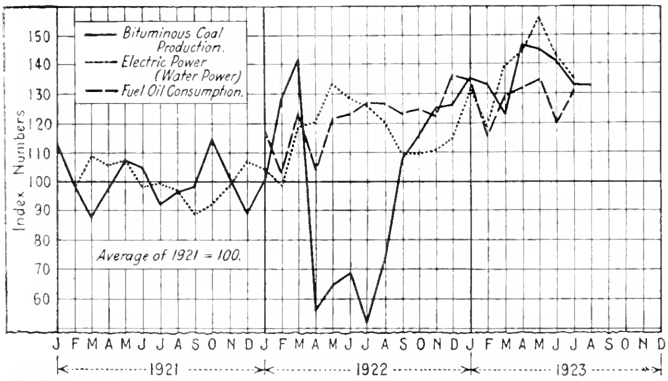
Fuel and Power

Bituminous Coal. Of the three curves in the fuel and power group, Fig. 5, that of bituminous coal production alone is corrected for seasonal variation. This stands at 132.8 for August as against 133 for July. Actually the production increased 9.1 per cent, but this was slightly less than is usual in August. There would have been a substantial rise in the adjusted index of bituminous coal production had it not been for the fact that mining was almost entirely suspended Friday, August 10, in tribute to President Harding.

Fuel Oil. The index of fuel oil consumption for July is 131. The June index was 120. While this increase is undoubtedly partly seasonal it is significant that the curve is at a higher point than it was at the same time last year.

Indications are that fuel oil consumption will continue at a high rate throughout this winter. Stocks are accumulating in the hands of refiners and decreases in prices are being made. Many buyers are holding out for further decreases, as fuel oil prices have been relatively firm when compared with general conditions in the petroleum industry.

Hydroelectric Power. During July the output of hydroelectric power continued the decline which began in the previous month. The index dropped from 142.7 to 134.8. A continuous decline beginning with June and extending through October is customary, but the decrease through July this year has been unusually large. While the output is greater than in any other July in the past four years, allowance must be made for the natural growth of hydroelectric production.



Sources, Department of Interior; Bureau of Mines; United States Geological Survey

FIG. 5 FUEL AND POWER CONSUMPTION

Building Activity in August

Indexes of construction volume for the month of August are conflicting. Actual *contracts awarded* as reported by the F. W. Dodge Company, and shown in Fig. 6, indicate that construction for the country as a whole fell off 5 per cent as compared with July, while reports compiled by Bradstreet's on *building permit* valuation for 85 of the larger cities show a gain of 14.7 per cent over the previous month.

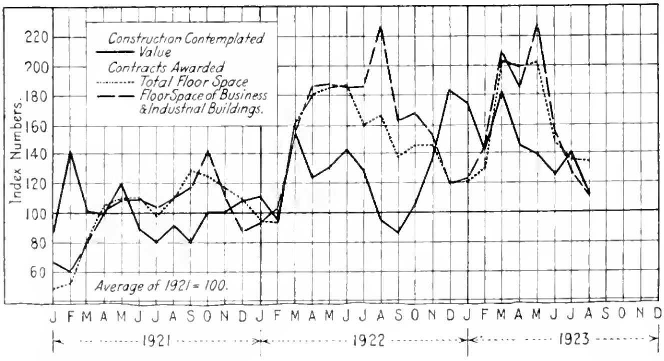
Probably the contracts awarded as reported by F. W. Dodge Company conform more nearly to the trend of construction industries than do permits issued for building. Permits issued may or may not be taken advantage of, whereas a building contract is more certain to be fulfilled.

Contemplated Construction. August saw a resumption of the downward trend in our index of contemplated construction which began in March of this year. The decline in August from July in contemplated construction amounted to more than 19 per cent, after adjustment for seasonal variation. But, even with this decline, the construction level remains well above the average for 1921.

No doubt high labor costs last month had considerable influence in postponing construction.

Contracts Awarded. The 5 per cent decline in contracts awarded for construction of buildings in August as compared with July compares with an increase in the same period of last year of 6.7 per cent. Contracts awarded in August of this year were 15 per cent less than for the corresponding month of 1922. The decline in August construction awards, however, brings the totals for the first eight months of 1922 and 1923 about equal. The anticipation of this development was reported in the July issue of MANAGEMENT AND ADMINISTRATION.

Although there has been a decline in contracts awarded in each month since May of this year, much of it can be attributed to seasonal variation, and a portion to the increasing costs of construction. Material costs have recently



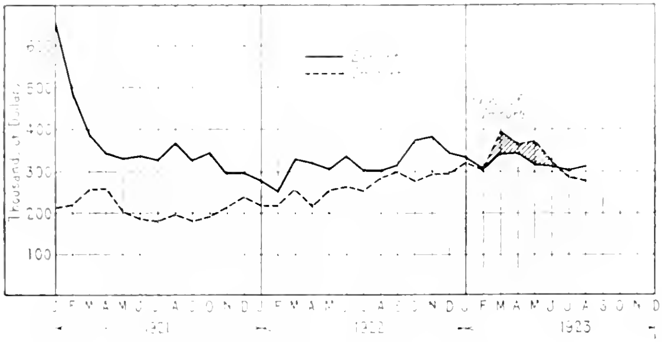
Source, F. W. Dodge Company

FIG. 6 CONTEMPLATED CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

become fairly stable, but labor continues to be a disturbing element. The decline in building activity has been gradual and orderly, and as labor conditions are improving the continuation of a fairly high level is probable.

Trend of Trade and Finance

Business Decline Ending : Money and Prices Firmer



Source, U. S. Department of Commerce

FIG. 7 FOREIGN TRADE OF THE UNITED STATES

Exports and Imports

Revised figures for the month of July show merchandise imports of $287,435,000 and exports of $303,000,000. (See Fig. 7). This gives a "favorable" merchandise balance of about $15,500,000, which is $10,000,000 less than the estimated balance had been.

Tentative figures for August place imports at $275,000,000 and exports at $313,000,000, with an estimated "favorable" balance of $38,000,000. The low estimate of imports for August—the figure is the lowest since July 1922—may be interpreted as resulting from the recent recession in trade and lower prices. Apparently the heavier imports in the spring anticipated the later requirements.

Conclusion. The favorable balance of trade is chiefly caused by the large decline in imports, rather than by the small gain in exports. This situation reflects the existing setback in our domestic business.

New York Stock Exchange

The trend of the stock market as shown in Fig. 8 is not encouraging. But little speculative interest has developed. Between the week ending August 4, and the week ending September 8, there was a gain in the average price of stocks amounting to about 3.9. But the volume of shares traded failed to follow up with the rise, and in the week ending August 15, there was a break in the stock market which wiped out most of the preceding gains. The daily turnover of shares jumped to over a million during the break. Clearly there is uncertainty and doubt as to the future of business.

Bank Debits and Postal Receipts

Bank Debits. The comparative quietness of trade during August can now be measured by the average of the weekly debits to individual accounts reported by 250 centers to the federal reserve banks and shown in Fig. 9. The weekly average for August was 15.5 per cent less than the average for the previous month and only 3 per cent larger than the same period of last year. September began with a week of smaller debits than the same week last year. The index of this item, after correction for seasonal variation, continued the downward trend which began in February of this year.

[illegible]

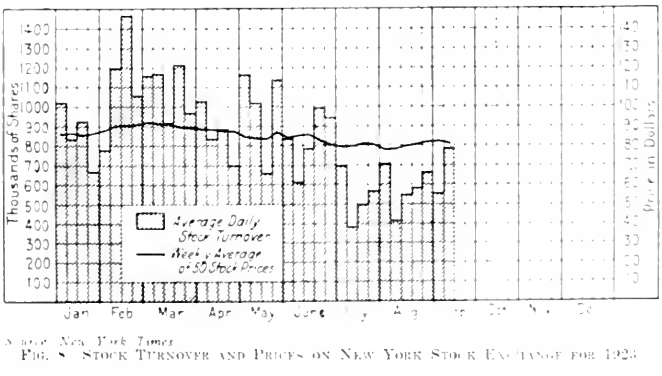
Retail Trade

Chain Stores. The chain store group of retail distributors, as shown in Fig. 10, enjoyed the largest increase in business over the previous month, which amounted to 6.8 per cent. The total volume of the four chain store sales aggregated $25,543,000 in August as compared with $23,918,000 the previous month and $21,676,000 the same month of last year. The first 8 months' business of 1923 for these 4 chain store organizations exceeded the total sales for the same period of last year by 21 per cent.

Mail Order Sales. The sales of Sears-Roebuck and Montgomery Ward combined fell off slightly in August as compared with July, but were 30 per cent greater than August of last year.

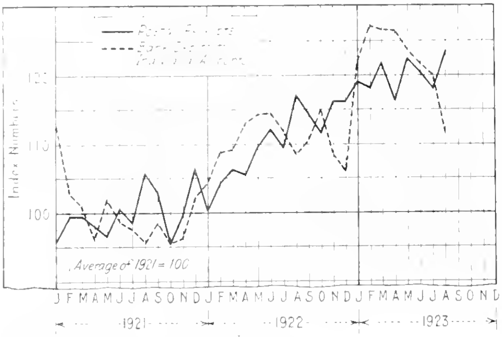
Department Stores. Department store sales as reported by federal reserve banks fell off during July, which is usually a very quiet month. Current reports, upon which no statistical data are yet available, state that August department store sales "came up to expectations."

Conclusions. If the total sales for the month of August in the better known chain stores and the two large mail order



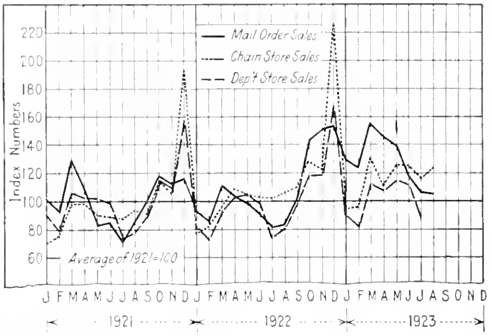
Source: New York Times

FIG. 8 STOCK TURNOVER AND PRICES ON NEW YORK STOCK EXCHANGE FOR 1923



Sources, Federal Reserve Board, Post Office Dep't

FIG. 9 BANK DEBITS AND POSTAL RECEIPTS
Both curves corrected for seasonal variations.



Sources, Commercial and Financial Chronicle; Federal Reserve Board

FIG. 10 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES
2 Mail order houses; 4 chain stores; 306 department stores.

houses are indicative of distribution of goods into consumers' hands, retail trade in general has held up quite satisfactorily to date. The August decrease in mail order sales, however, seems to indicate reduced purchasing power in farming communities.

Prices and Interest Rate

One of the outstanding facts concerning August was the change in the general trend of wholesale prices. (See Fig. 11). Both Bradstreet's and Dun's indexes showed similar small advances. These advances reversed a four months' decline.

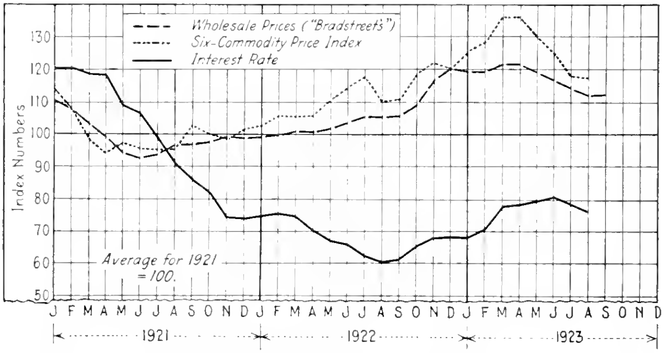
Bradstreet's Index. Taking Bradstreet's price index as most representative, and letting the average for 1921 equal 100, it appears that on March 1, a high level of 121.6 had been reached. The index number declined to 112 on August 1, and rose to 112.8 on September 1.

This small advance was almost entirely due to higher prices for meats and other animal products, live stock and groceries. Small gains were also made in cotton and cotton goods, naval stores, coal and coke, and the metals group. Declines were registered in the case of fruits, hides, and leather, oils, building materials, and chemicals and drugs.

Six-Commodity Price Index. Our sensitive six-commodity price index for August declined about one-half of one per cent. It is to be noted that this index is an average for the month, and if it had been computed as of September 1, it would also have shown an increase.

Interest. The index showing the trend of the interest rate declined slightly in August, and now stands almost exactly at the normal level for this season of the year. The actual rate on commercial paper advanced about one-fourth of one per cent toward the end of August, but the average rate for the month as a whole failed to advance as much as is normal at this season.

Conclusion. Since the downward trend of prices has been checked, an increase in forward buying is likely. As soon as buyers are convinced that the bottom has been reached they will place orders more freely. If the slight upward trend in prices becomes a general upward movement, the interest rate will also increase in two or three months. *The present outlook is for firm to rising money rates during the remainder of the year.*



Sources, Commercial and Financial Chronicle, Federal Reserve Board

FIG. 11 WHOLESALE PRICES AND INTEREST RATE
Interest rate is the monthly average, corrected for seasonal variation.

Failures and New Business Enterprises

Failures. Failures reported by Dun's for the month of August numbered 1319. This is an increase of 6.7 per cent over the previous month, but 29 per cent less than the number of failures occurring in the same month of last year. While the seasonal index of failures as computed by the Bureau of Business Research is larger for August than for July, the actual increase was greater than is usually experienced during this period. The index for August, shown in Fig. 12, is secured by correction for seasonal variation and "smoothing" by averaging with the indexes for the two preceding months. It shows that the general trend of failures may still be downward. However, whether the downward trend of the failure curve will continue is uncertain, since the number in August increased so considerably.

In view of the general dullness of trade which has existed during the past six weeks these trends are of more than ordinary importance. It is evidence that as time passes business enterprises are steadily improving their condition and the number of firms finding it necessary either to liquidate or to reorganize has become gradually less.

New Enterprises. The launching of new enterprises during August showed a downward trend for the second con-

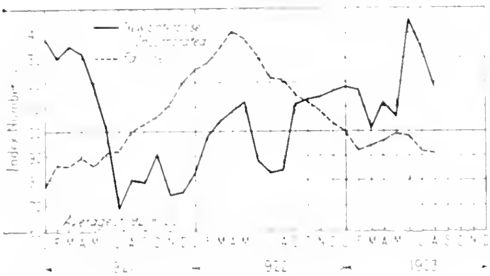


FIG. 12 BUSINESS FAILURES AND NEW ENTERPRISES

Adjusted for seasonal variation; 3 months moving average.

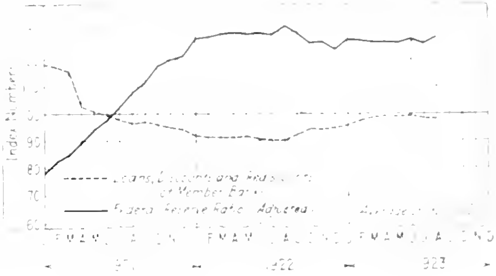


FIG. 13 BANK C[illegible] F[illegible]

Federal Reserve Rat[illegible] deposit liabilities.

[illegible] secutive month. New incorporations with an authorized capitalization of \$100,000 or over totaled only \$335,000,000 against \$725,000,000 in July. With one exception (June 1921) August saw the lightest volume of new security issues for any month within the last three years. A portion of this small volume is attributable to seasonal influences, as the third quarter of the year is usually the lightest period of the year in the issuance of new securities.

Conclusions. Developments in the bringing out of new securities and the trend of failures indicate some increased uncertainty as to the business future. In neither of these factors, however, is evidence found which would forecast a marked change in business conditions within the near future.

Bank Credit

Fig. 13 shows that during the month of August there was no change of importance in the banking structure of the United States as a whole. This fact is noteworthy in view of a change in the presidency of the country and impending labor troubles.

Loans and Discounts. Total loans and discounts of the 769 reporting member banks of the federal reserve system totaled \$11,707,551,000 on August 29. This amount is 0.2 per cent less than a month ago and 10 per cent greater than a year ago at this time. At no time during the last seven months has there been a change greater than 1 per cent in any one month in the total loans and discounts of these banks, which indicates [illegible] stable condition existing within the banking field.

Federal Reserve Ratio. The position of the federal reserve banks has also remained practically unchanged. After eliminating seasonal variations, the ratio of reserves to deposit and federal reserve note liabilities combined rose less than one per cent, a change of minor significance considering the high reserve ratio obtaining.

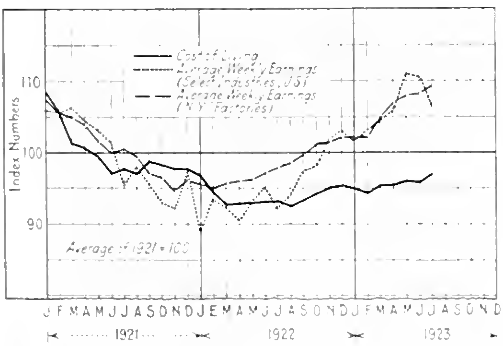
Wage and Employment Situation

Wages Pass Peak : Employment Stabilized

Earnings and the Cost of Living

During July there was a decrease in the actual average weekly earnings of workers in both New York factories and selected industries throughout the United States, which is shown in Fig. 14. In New York, however, allowance has been made for a 2 per cent normal decrease in July. Hence the adjusted curve of earnings in New York factories shows an advance from 108.2 to 109.3, the 1921 average being 100. This is the highest point since 1920.

Selected Industries in the United States. The curve of average weekly earnings for selected industries throughout the United States is not corrected for seasonal variation, and this curve indicates a decrease of 3.5 per cent in earnings, taking the 17 chief industries which the Bureau uses in preparing the index. For these industries decreases of 6 per cent and 3 per cent, respectively,



Sources, U. S. Bureau of Labor Statistics, N. Y. State Dept. of La[illegible] National Industrial Conference Board.

FIG. 14 WAGES AND COST OF LIVING

New York factories curve corrected for seasonal variations.

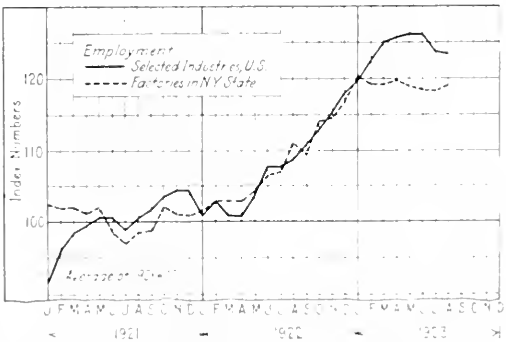


FIG. 15 THE TREND OF EMP[illegible]

New York curve corrected for seas[illegible]ns.

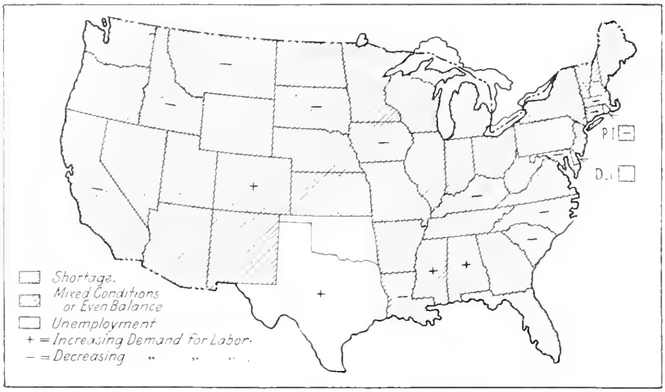


FIG. 16 CONDITION OF EMPLOYMENT BY STATES, JULY 1923

were recorded for the same month in 1921 and 1922. Hence the decline is undoubtedly largely seasonal.

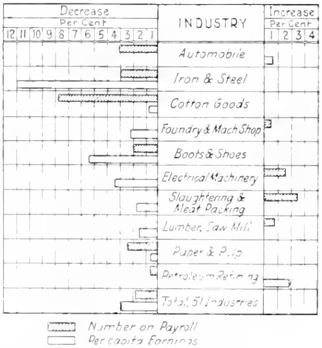
Cost of Living Increases. The cost of living index of the National Industrial Conference Board for July showed an increase. This curve now stands at 97.1 per cent of its average for 1921, representing an advance of over 1 per cent from June. The cost of living is now at the highest point since December 1921.

Conclusions. Since a rise in the cost of living, other things being equal, causes a decline in the purchasing power of labor, the net result for July was not favorable to industrial workers. The curves of average weekly earnings and the cost of living showed a slight tendency to converge, due to the greater rise in cost of living. Further movement of this kind is likely, as the spread between wages and commodity prices has become greater than conditions seem to warrant. Either prices must go up, or wages come down, or both.

The Employment Trend

As shown in Fig. 15, the sharp decline in the index of employment in the United States during July is notable. There was a further small decline in August. This confirms our opinion expressed last month that the peak of the labor shortage of recent months has been passed. The decline is partly seasonal.

Employment in New York. After adjustment for seasonal variation, the curve of employment in New York State factories advanced slightly in August from 118.3 to 119. It is probable that the September index will register a decline, since reports from employment offices show a tendency to a falling off in the demand for labor, and there is a normal September advance of nearly 4 per cent to be overcome.



Source Bureau of Labor Statistics

FIG. 17 TREND OF EMPLOYMENT AND EARNINGS, JULY 1923

Employment Map

Fig. 16 shows a general easing in the employment situation in July as compared with June. While there was a general shortage of agricultural labor, employment of other classes of labor was very evenly balanced, with hardly any shortage and with many indications of the decline in unemployment. The number of states showing a condition of labor shortage was reduced, and the number showing a declining tendency in employment increased.

Employment in Selected Industries

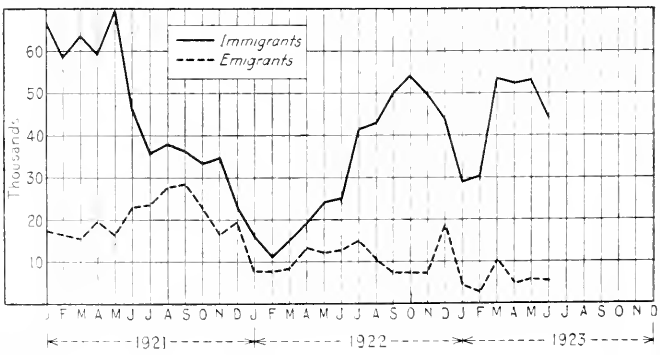
The 10 leading industries selected for detailed analysis in Fig. 17, as to employment and per capita earnings, show further decline in July.

Employment. The largest declines in employment occurred in cotton goods, iron and steel, automobiles, and paper and pulp. Even greater declines were registered in certain industries not shown in the chart: automobile tires, stoves, and glass. On the other hand there were increases in employment in slaughtering and meat packing, and electrical machinery, and even larger increases in the manufacture of fertilizers, and car building and repairs.

Per Capita Earnings. Only 10 out of 51 industries showed an increase in per capita earnings in July. Large decreases occurred in iron and steel, boots and shoes, and electrical machinery—also in the manufacture of automobile tires and stoves. Among the 10 leading industries, increased weekly earnings were shown in the petroleum industry and in the manufacture of automobiles.

Immigration and Emigration

The latest available figures on migration, as shown in Fig. 18, are for June. In that month there was a decline in number of both immigrants and emigrants as compared with May totals, the decline being greater in immigration. The June figures follow: Immigrants, 44,166; emigrants, 5,414; net gain, 38,752. Immigration has relieved labor shortage near Atlantic ports.



Source, United States Bureau of Immigration

FIG. 18 IMMIGRATION AND EMIGRATION

CURRENT BOOK REVIEWS

Hoisting and Conveying Equipment

B[illegible] CONVEYORS AND B[illegible] E[illegible] B[illegible] V. Hetzel. [illegible] pp. J[illegible] W[illegible] Sons, I[illegible]

REVIEWED BY R[illegible] T. K[illegible]

[illegible]

Class Number
621.86 Conveying Machinery

IN his preface the author says: "This is intended to be a practical book." As the reviewer sees it, a more practical book could scarcely be written.

The author of the book is literally a master of his subject. In his 30 years of experience in the designing and building of hoisting and conveying machinery he has learned exactly what kind of information the designer, the builder, and the user of this kind of equipment need.

This information, clearly and tersely expressed, is set forth in the present volume. There are very few questions regarding belt conveyors and belt elevators the answers to which cannot be found in the pages of this book.

To the casual observer, and even to many engineers, the belt conveyor is an exceedingly simple piece of machinery. Comprising, in general, a belt supported on idlers, with a driving pulley at one end, and loading and discharging devices at the necessary points, it does not appear to be a structure of many engineering possibilities. Nevertheless, there are few types of machinery in which neglect of good engineering can cause more operating troubles, and conversely, there are few which are more satisfactory when properly designed and operated. Mr. Hetzel's book gives the key to satisfaction.

The factors that must be considered in the design and use of a satisfactory belt-conveyor installation are indicated by the chapter headings. The first two chapters, general in character, deal with descriptive and historical matter. Then follow 11 chapters dealing with belts and belt manufacture; supporting, guiding, and driving the belt; tension and make-up devices; loading, discharging from, protecting and cleaning the belt; package conveyors; special uses of belt conveyors; life of belts; when to use belt conveyors.

These chapters are not merely a series of descriptions of devices. They are replete with formulas, tables, design factors, performance curves, construction details that have been successful and construction details that have failed, together with information as to why they have succeeded or failed. The book tells not only what to do, but also what not to do.

The second section, devoted to belt elevators, is equally complete. It comprises 10 chapters, covering the following subjects: general descriptions; centrifugal discharge elevators; elevator buckets; continuous bucket elevators; belts for elevators; fastening buckets to belts; dr[illegible]ing [illegible] tors, elevator [illegible] veyors, this section [illegible] for designer, builder [illegible]

Up to the present time [illegible] covered by this book has been [illegible] fragmentary. It has consisted mainly of papers [illegible] in the transactions of engineering societies, scattered paragraphs in handbooks, miscellaneous magazine articles and catalogues of manufacturers. No[illegible] has there been an authoritative treatise covering the [illegible] subject. Mr. Hetzel has gathered together these [illegible] data, supplemented them with a wealth of hitherto [illegible] published information from his own experience and woven the whole into a book that leaves little to be said on the subject.

A Cambridge View of Economics

MONEY, CREDIT AND COMMERCE. *By Alfred Marshall.* [illegible] *pp. Macmillan and Company, Ltd.*

REVIEWED BY THOMAS YORK

[illegible]

Class Number
330 Economics

THE author of this volume is the well-known British political economist, professor at Cambridge University and frequently referred to as the dean among his confreres in England.

Undoubtedly many a reader of this review is familiar with the author's first work, "The Principles of Economics," published as far back as 1890, which is so often used in college classes, either as a regular text or as supplementary reading. With this early volume Professor Marshall launched upon the scheme of publishing a series of works in economics which was to be almost all-embracing in its scope, having for its main purpose, to use his own words:

> . . . to study the direction of man's efforts for the attainment of material ends, and to search for possibilities of improvements in that procedure which may increase the command of the peoples of the world over their resources, and enable them to develop their higher faculties.

The present volume is the third of the contemplated group, and as the author states, the completion of his task will require a fourth.

In his earliest work Professor Marshall deals with the more fundamental principles of wealth distribution, laying emphasis particularly upon the general law of supply and demand as it applies not only to commodities but also to the various economic agencies including land, labor, and capital. In the second volume of the series, entitled "Industry and Trade," which made its appearance only a few years ago, he presents a study of industrial technique and business organization, and of their influences on the conditions of various classes of people and nations. In his latest volume he considers the influence of money, credit, and international trade on the conditions of man's life and work. The series is to close with a volume, now in course of preparation, which is to embody some of the notions which he has formed in all these years of economic study and observation as to the possibilities which exist for the world's social advance.

Like Professor Marshall's earlier works the present volume is a very learned treatise, marked by great profundity of thought and thoroughness of treatment. However, there is very little contained in it that can be taken as representing a fresh contribution to the sum of economic knowledge. It rather turns over and examines, in greater detail, though along the same general lines, topics with which every student of economics is more or less familiar. A very striking feature is the wealth of detail with which the discussion is enriched. The experience of all the ages, it seems, is drawn upon for purposes of illustration.

The book is formally divided into four parts, dealing respectively with money, credit, international trade, and fluctuations in industry, trade and credit. The fullest treatment is given to the underlying principles of international trade, certain aspects of which, such as the elasticity of a country's demand for imports and the incidence of taxes on imports and exports, are discussed with a considerable degree of minuteness.

Particularly in the numerous appendices attached to the book, Professor Marshall shows his familiar fondness for the diagrammatic and mathematical handling of economic questions. On this account some of the pages of the volume will appear quite forbidding to the ordinary reader. Indeed, though its style is simple and clear, the book is hardly suited for anyone but the specialist in economic science. It is concerned too much with general theory and not enough with present-day problems in the world of industry and finance, to excite the interest of men whose minds are centered on practical affairs.

One of the very serious criticisms to which the volume is open is its almost complete failure to take adequate notice of the financial and industrial conditions by which the world at large is now being harassed. In the chapter on international exchanges, for example, the subject of depreciated foreign currencies is dismissed with a few general statements of principle, and there is hardly more than a bare allusion to the present abnormal state of the exchanges.

This tendency to neglect the experience of recent years and instead to borrow illustrative material from the more or less distant past is quite characteristic of the book. It is very surprising that Professor Marshall should have made such meager use, in this latest of his works, of the wealth of material which the last decade has developed. It would have added greatly to the general readableness of the book if he had discussed the principles of money, credit, and international trade in the light of modern experience instead of harking back, for example, to the Indian experience of 40 or more years ago, as he not infrequently does.

A Challenge to Industrial Leadership

BUSINESS CYCLES AND UNEMPLOYMENT. *Report of a Committee of President Harding's Conference on Unemployment, with a Foreword by Herbert Hoover. 422 pp. McGraw-Hill Book Company, Inc.*

REVIEWED BY HENRY BRUÈRE

Fourth Vice-President, Metropolitan Life Insurance Company

Class Number
338.97 Business Cycles
331.1 Unemployment

OWEN D. YOUNG, chairman of the Board of the General Electric Company, was chairman of the committee which had this study in charge. As chairman, he signs with other members of his committee the report and recommendations of the committee, which are supported in a general sense by the various papers on the special studies collected under the auspices of the National Bureau of Economic Research.

The report is prefatory, about 33 pages, to the collected papers, which add 389 pages more to make a somewhat too formidable volume. The whole volume will not, I suppose, be read by many persons who should read it. It is quite a chore. The report itself should be read by every business man who is more than an animated cash register.

The story is told in the report, which is the meat of the whole matter. Lots of people have said it, but it is now told by a business man of judgment, deliberately and soberly, that business is carried on in the dark. Business men do not know the facts about the complicated and terribly important economic current they drift upon. They cannot know. The facts are not within their province.

An individual business is a mighty small cog in the economic structure, no matter how big that business may seem. There must be pooling of facts, and a general understanding of them. Somebody must make it his business to know them—the banker for example—and to explain them to the business man whose contacts are not equally wide.

Facts, understood facts, are the first requirement in any program for converting the business cycle curve into a reasonably straight-away line, without too many undulations. There are expedients, of course, such as unemployment insurance, employment agencies (to reduce avoidable unemployment), and the withholding of public improvement projects until hard times come about. But the main thing is to cure the staggering of business, staggering in the dark brought about by blows from unexpected quarters.

I have not been quoting Mr. Young. I have not been paraphrasing his statement. I have been saying with informality what he says with the orderliness of a chairman of an important committee. The important *fact* is that he says it. The most important *hope* that the book inspires is that he and others like him (there are not too many), will continue to say and to show that acting with knowledge of all the essential facts means good business, steady business, and a minimum of fluctuations in employment in their own particular businesses. Mr. Dennison, for example, has done so.

The second most important statement contained in the book, in my judgment, is the discussion of production stabilizing, contributed by N. I. Stone of the Hickey-Freeman Company. My reason for thinking so is that he shows that Dennison actually succeeded in doing more business in crepe paper and sealing wax in 1921 than ever before, by virtue of anticipating the slump a year in advance, and organizing to counteract it.

In introducing the special studies, Professor Wesley C. Mitchell discusses with his customary clarity his specialty, the business cycle. It would have been better had Dr. Mitchell taken most of the balance of the book in hand and written what it would be helpful for the student of the problem, business man, politician or what not, to be told or have laid before him. He could not, however, have done the discussion of "Unemployment Insurance" (Chapter XVIII) better than did its author, Professor Leo Wolman, of the New School for Social Research. It is a clear, untinged review of the momentous British experiment.

There are other distinctly valuable summations in the volume, such as Shelby M. Harrison's paper on "Employment Offices." But the book needs rewriting. Professor Mitchell could do it admirably, of course. But he would not have needed the encouragement of a Presidential Commission to accomplish it. I wish that Judge Gary would take all the data that the Committee has gathered and on the basis of it work out a comprehensive guide to American business men for an anti-cycle movement.

In 1915 I persuaded the Judge to serve as Chairman of Mayor Mitchel's Unemployment Committee, and the Judge encouraged a studious attempt by his committee to analyze that year's unemployment problem. But the preoccupation of relief measures and the sudden swing into pre-war prosperity limited the attention which the business men on the Committee gave to preventive planning.

This effort to prevent depressions must be taken up as a business problem. Labor as it is now organized is impotent to deal with it.

The book is epochal because it means that at last the problem of unemployment is recognized as integral with the whole affair of revising our accepted economic thinking and action. It will do good, if only by starting others thinking. It will do an immense amount of good if Mr. Young and his associates find ways of putting in motion the determined co-operation of business men and organizations, to find the facts, communicate them, and teach how constructive action may be taken on them.

Mr. Hoover is in a pivotal position to make possible the regular collection of facts. He is doing that in the Department of Commerce. But business men must understand the facts and act on them. Those who collaborated in supplying the supporting statements to the report were, in addition to those mentioned above, Mary Van Kleeck, Sanford Thompson, Gilbert H. Montague, Ernest S. Bradford, Julius H. Parmelee, Otto T. Mallery, Professor T. S. Adams, Dr. John B. Andrews, Oswald W. Knauth. Not a captain of industry in the list, and not a leader of those chiefly affected by unemployment labor.

Factors of Uncertainty in Business

RISK AND RISK-BEARING. By [illegible] O. Hardy. *The University of Chicago Press.* [illegible]

Reviewed by [illegible]

[illegible]

Class Number
658.1 Business Hazards

THIS thorough-going study of the influence of uncertainty in business affairs, by the Professor of Economics at the State University of Iowa, should really be reviewed by a syndicate made up of a competent banker, a lawyer, an economist, an investment specialist, a life insurance actuary and the chief of the fire department. It is many kinds of a book in a single binding, which makes it valuable to the user and somewhat puzzling to the reviewer.

With such a broad field to cover, Professor Hardy wisely attacks his subject with spirit in the opening pages, classifying business uncertainties in accordance with their origin, as follows:

1. Risks of destruction of property through the physical hazards of nature (storm, flood, fire, etc.).
2. Uncertainties in the productive process (strength of materials, effectiveness of labor, variations of weather).
3. Social hazards (risks due to deviations of individual conduct from what is expected, such as robbery, defalcation, forgery and the like. This also covers risks due to the impossibility of predicting the behavior of social groups, as illustrated in strikes, riots, wars, tariff changes, tax reforms, and prohibitory laws).
4. Risks due to individual ignorance. (It is risk of this character which keeps down the competition to seize favorable business openings and makes it possible for persons of superior knowledge and skill to profit by their superiority.)
5. Market risks. (During the time which elapses between the purchase and sale of commodities, unpredictable changes often occur in the prices and other market conditions surrounding the commodities dealt in. This constitutes the most important of all the groups of business uncertainties.)

In Chapter II Professor Hardy presents an admirable analysis of the methods of dealing with risks:

A. Elimination of risk by:
   1. Prevention of the harmful events.
   2. Forecasting, or research to remove the uncertainty.
   3. Combination of risks.
   4. Accumulation of reserves.
   5. "Compensation," or offsetting of risks.

B. Assumption of risk:
   1. By owner-managers.
   2. By investors and speculators.
   3. By laborers.

C. Transfer of risks to others:
   1. Transfer to entrepreneurs, from
      (*a*) Laborers, through the wage system.
      (*b*) Capitalists, through the interest system.
   2. Contracting out.
   3. Hedging.
   4. Insurance.
   5. Guaranty, suretyship, underwriting, etc.

The first four chapters, in particular, are well worth the careful study of any business executive who wants to have a clear idea of the principles underlying business hazards, and he who does not is no executive. The fifth and sixth chapters cover the business cycle and methods of forecasting. Investment and speculation claim the next six chapters, followed by three on life, fire, and miscellaneous property insurance; one on guaranty and suretyship; one on the various risks of labor; and a final chapter entitled "Social Aspects of Risk-Bearing," which treats of a variety of topics including profit-taking, profiteering, the ethics of speculation, and risk under a socialist form of government.

To the reviewer, whose special interest in risk bearing is frankly from the insurance angle, Professor Hardy's book seems to be full of nourishing meat. Perhaps one of its greatest services will be to the investment broker, the insurance man, the title company executive, who needs to study risk-bearing in its broader aspects in order to understand the true relation of his own business to the general principles underlying all business hazards.

Because of the wide extent of the field covered, Professor Hardy has had to stick to essentials, which is a blessing to the busy man who has little time for reading. Each chapter constitutes a "boiled-down" statement of principles, and if the reader does not grasp them it is because he will not pay the price of a reasonable degree of concentration.

The fact that this is designed primarily to serve as a textbook detracts not a bit from its appeal to the business man. Indeed, answering the questions which are supplied at the end of each chapter is a most convenient way for the reader to fix the ideas in mind.

"A Good and Useful Book"

INDUSTRIAL AMERICA IN THE WORLD WAR. *By Grosvenor B. Clarkson. 573 pp. Houghton Mifflin Company.*

REVIEWED BY CHARLES H. SNOW

Dean, School of Applied Science, New York University

UNTIL recently, warfare between two civilized nations was in the nature of a comparatively simple military duel. Soldiers were active, but civilians were not. It even happened that homes at a reasonable distance from the battle line were not seriously inconvenienced during warfare. The late conflict stands out, not only because of the immensity of its military operations, but because civilians as well as soldiers, industry and commerce as well as army and navy, were so organized and directed as to function as part of the fighting nation. Some one has said that in future wars everyone must either "fight or work." The present volume has to do with those who worked during the recent conflict, and with the results accomplished by them.

That an unprepared, undisciplined, and unwarlike people should succeed in mobilizing its industries so quickly and effectually will come to be regarded as one of the wonders of the age. Germany has thought in terms of war for many years. Her government was so autocratic that civilians had learned to obey as promptly as soldiers. But America is not an autocracy, nor are her citizens warlike. Described as a nation of individualists and shopkeepers, the majority detested war and knew practically nothing about it. It is true that a realization of the need for preparedness had existed in the minds of some, but the country as a whole was almost totally unprepared for war when war began. At almost every point the United States was the antipode of Germany.

Mr. Clarkson tells of the Council of National Defense and its lusty child, the later all-powerful War Industries Board. The United States was a vast reservoir of energy and materials, but no means existed by which the many parts could be brought together and used in the defenses of the nation. The creation of the machine by which this task was accomplished did not go forward steadily. The field was untried; there were experiments, progress was intermittent, but the result was one which, before the war, would have been deemed impossible. The United States was made ready to fight a war 3000 miles away, to assume the principal burden and fight through to a finish in case France and England should become exhausted. Great Britain, mistress of the seas, had done much when she placed 250,000 men in South Africa during the entire period of the Boer War. But the United States placed more than that number in France during a single month, supplied them liberally and at the same time poured unstinted quantities of food, fuel, materials, and ammunition into France for the allied armies. Interesting references are made to America's indirect participation in the war. For example, it is assumed that the United States achieved no very real result in the preparation of aeroplanes, yet Mr. Clarkson shows that while the number of completed aeroplanes which reached France from the United States was not large, the quantities of machine parts and materials supplied did much toward securing for France her supremacy in the air.

A section is devoted to the system of priorities. Should a limited number of locomotives just ready for delivery be sent to France to carry troops to the front, or should they be sent to Chili to hasten the delivery of nitrates, without which cannon would become useless? Until a system had been worked out, the only rule of preference was the good old rule of "first come, first served," except as between army and navy where there was an understanding that for a time the navy was to have right of way. The education of the nation, the control of prices, balancing supply and demand, the control of labor, conservation, materials, and many other subjects are detailed in an authoritative manner.

The War Industries Board was the greatest gathering of first-grade business men working for a single end that this country or any other has ever known. It was a collection of remarkable personalities, individualists selected from a nation of individualists. It included not only presidents and chairmen of boards whose hardest working days were over but keen dynamic, forceful, purposeful superintendents and managers of the very first grade.

As former Premier Clemenceau writes in his introduction: "Here is a good and useful book. The industrial history of the war has never yet been written. To it, Mr. Grosvenor B. Clarkson makes a first and authoritative contribution."

Forms of Compensation and Reward

FINANCIAL INCENTIVES FOR EMPLOYEES AND EXECUTIVES. *By Daniel Bloomfield. 742 pp. H. W. Wilson Company.*

REVIEWED BY RUDOLPH M. BINDER

Professor of Sociology, New York University

THE author of this book has brought together a vast amount of material, culled from more than a thousand concerns and plans and covering every possible incentive to employees and executives. The various plans presented have all been tested in at least one plant. They are confined chiefly to financial aspects, philanthropic measures being touched upon only incidentally in the discussion.

After a brief introduction Mr. Bloomfield takes up types of wage systems: piece-work; work by day and week; and bonus plans for increased production, economy, steady attendance and length of service. In the second volume he discusses thrift plans, profit-sharing, stock participation plans, mutual benefit associations, pensions, compensation of salesmen, rewards for office workers and incentives for executives.

A bibliography covering 11 pages and a fairly complete index are additional helps to the reader who wishes to pursue the study further or to turn to a particular topic quickly. Typographically the book is of a high order.

Undoubtedly, incentives are today more vital than ever before in the history of industry. The old tactics of trade unionists—screwing up the wages and clipping off the hours—have about reached the high-water mark. If labor is to get greater returns, labor and management must accomplish more, since wages can be paid only out of the proceeds of production. Specific incentives seem to point the way for this accomplishment.

What are the basic principles of incentive plans? They should increase the service of the employees both to themselves and to the employer. They should promote confidence between capital and labor. They should not represent paternalism or philanthropy but should provide substantial benefits to the worker in addition to the current rate of wages. Employees should be informed concerning the factors entering into the payment of the extra compensation. They should, if possible, be represented in the administration of the plan.

Further, every enterprise should select the plan most suitable to its particular conditions. Every plan, if it is to result successfully, depends on the effort of the management. This requires not only an adequate preparation and equipment on the part of the manager but above all good-will, kindness, and a genuine interest in the employees as human beings.

In the light of these principles the author examines the different incentive plans now in operation. Under "Types of Wage Systems" in Chapter II he discusses the contract system, the Halsey premium plan, the task and bonus plan, the differential piece rate or Taylor plan, and the Emerson plan. He then cites specific cases in which these varying plans have been tried.

Under each type of wage system he gives a clear and terse discussion of the advantages and disadvantages claimed, and proved or disproved. It is interesting to note that a given plan does not always work equally well in two enterprises of a similar nature. This indicates that each enterprise should work out a system of its own, possibly by adapting one found successful elsewhere. It also proves the need of an alert and circumspect management for determining exactly what system best meets its own specific requirements.

Suppose that a manufacturing plant decides to encourage production by paying a bonus. It makes a big difference whether, for instance, the pattern-maker for marine engines is paid the bonus every week, or whether he has to wait until the engine has been built and tested. That may be a long way off; something unfortunate might happen—the interest lags. But that possible extra pay coming on Saturday with the pay envelope—that seems close by, and keeps the man interested. There are many other considerations, apparently unimportant, which have a direct bearing on how well a particular plan is likely to work out in a given enterprise.

In some cases, all the uncertainties of production are put on the workers, as, for example, when men are paid by the car for unloading coal and the switchmen are tardy in moving empties away and in setting in the loaded cars. The piece rate must, of course, be handled with the greatest skill if it is to work satisfactorily. On the other hand, the "day-pay" principle may seem equally unjust, since it assumes that every bricklayer's time for 8 hours is worth \$10, or every hodcarrier's \$5. Some men certainly earn more; others earn less. The need for some system of special payment for extra skill thus becomes evident. It can be met only by paying current wages to all employees, and fairly rewarding additional effort through some incentive plan.

The pension plan is adequately treated by Mr. Bloomfield. One of the greatest anxieties of nearly every worker is dependent old age with all its misery. Many employers believe that if they could remove this fear, the worker would be more loyal, efficient, and thrifty, and the labor turnover could be reduced. They have been met more than half way by many employees, chiefly by those of better grade. Accordingly numerous pension systems have been inaugurated. The effect has not always been favorable. In general, the middle-aged, married, and better paid employees have expressed appreciation, become more loyal and efficient, and paid less attention to radical propaganda. The younger, unmarried, and more self-reliant workers have shown

themselves more interested in higher wages, shorter hours, and plans which promised higher returns in the near future.

The author discusses every possible phase of the incentive idea which has been tried out, showing its applicability under certain conditions and its lesser utility under others. The book is a mine of information, and any employer is likely to find in it a plan which, with some modifications, will accord with the particular conditions obtaining in his plant. Industry's greatest need today is more effective production, which is appreciably furthered by better understanding between employer and employee. The author of this book deserves credit for pointing out many ways which lead directly to such an understanding.

Helping the Jobless Worker

THE BURDEN OF UNEMPLOYMENT. *By Philip Klein. 260 pp. Russell Sage Foundation.*

REVIEWED BY JOHN B. ANDREWS

Secretary, American Association for Labor Legislation

Class Number
331.1 Unemployment

"THERE remains for the present, and probably for years to come, the question of what to do with the distress caused by unemployment . . . and how the community is to bear the burden imposed upon it," says the author of this publication. The avowed purpose of the study is to be of service to the charitable agencies during times of industrial depression.

The study reports the experience of 15 cities in dealing with emergency unemployment relief in 1921-1922. It discusses the meaning of unemployment to the worker, the organization of unemployment committees, the distribution of work, and the "relief aspects" of unemployment. Greatest stress is placed upon "the task of social agencies in meeting the emergency." A chapter on "The Homeless Man"—"in a sense the least important of the many problems"—is perhaps the best organized in the book. The volume concludes with perfectly safe recommendations in favor of better employment statistics. In fact the two chapters on the use of employment statistics and on statistical indices available in a community, are the most helpful as well as the most scientific.

Public employment bureaus are approved and the announcement is made that the long-awaited report of the Sage Foundation on this subject will appear. Not the least of the merits of the present volume is its fairly prompt publication.

The long-range planning of public works—"largely an untried though generally approved method"—is briefly endorsed by the author in these words: "No single measure promises greater returns for emergency relief."

The most recent Chicago Commission on Unemployment is scolded with apparent justice by Mr. Klein for its failure to recognize the good work done by its predecessor. The absence of any knowledge of the record of its predecessor's [illegible] against any [illegible]cessful administration [illegible] against secondary research, says Mr. Klein. This is sound criticism. But unfortunately Mr. Klein has himself totally failed to indicate any knowledge of the several earlier published reports upon the emergency experience of American cities in dealing with out-of-work relief which most closely parallel his own detailed study.

Many social workers of the very class to whom he addresses his report, and who no less conscientiously and unselfishly although with less available funds cooperated in preparing the published reports upon the unemployment crises of 1914-1915 and 1920-1921 will learn with amazement that "Recognition of the lack of objectively recorded experience of the recent emergencies prompted the Russell Sage Foundation to undertake the present study." And it is again asserted that "A deplorable lack of . . . a guide for future depressions of a similar nature has been redeemed by only a few scattered descriptions detailed enough to be of real value and these have thus far not been published." Of two somewhat similar published reports, one of some 200 pages is almost as detailed as this book, and each concludes with specific recommendations, out of the experience of these same social workers, for dealing with future periods of unemployment.

The author disclaims any intention of discussing "such matters as unemployment insurance, pensions, and similar proposals." This book is primarily for the social workers of the class known as "charity workers." Practical business administrators and employment managers as well as economists in general will find the book less useful.

Perhaps it is not to be expected that some of the equally interesting and important but controversial phases of unemployment relief would have attention in a report of one of the great foundations. Some of them avowedly refrain from discussing the more controversial issues. But this volume is a worth-while addition to the gradually extending list of American publications dealing with one of our most complex industrial problems.

A Source Book for Personnel Workers

PROBLEMS IN PERSONNEL MANAGEMENT. *Compiled and edited by Daniel Bloomfield. [illegible] pp. H. W. Wilson Company.*

REVIEWED BY W. J. DONALD

Managing Director, American Management Association

Class Number
658.4 Personnel Management

THIS addition to "The Modern Executive Library," published by the H. W. Wilson Company, and edited by Daniel Bloomfield brings down to date Mr. Bloomfield's former volume on "Employment Management." It certainly does succeed in making use of some of the most recent literature such as the report of the subcommittee of the National Economic League, published in July 1924, and also

Professor Henry R. Seeger's address on "Company Versus Trade Unions" delivered before the American Economic Association in December last and published in March 1923.

In general the literature quoted is of recent origin, though it does include certain valuable papers of earlier vintage. As a source book the volume is a collection of a comparatively limited number of extensive papers, rather than a selection of the best parts of many papers by writers who may represent different points of view. Mr Bloomfield has adopted the easier method of compiling and editing such a book.

A selected bibliography of the most important recent books and magazine articles precedes the introduction. The table of contents simply lists the titles of chapters. One might gain from it the impression that the whole book had been prepared by the author. Such an impression could have been avoided and the table of contents would have been greatly improved if it had contained under each chapter title the names of the articles listed, together with the names of authors.

The title of the book, "Problems of Personal Management," raises a current issue as to the function of the manager of the personnel department. The first article included, entitled "Man-Management; A New Profession in the Making," might lead the reader to think that it is the function of the manager of the personnel department to "manage" the men. Nowhere in the volume does one find a formal recognition of the part played by the line executives in "man-management." No one would dispute the important part played by the manager of the personnel department in progressive industrial concerns today, but it should be recognized that the personnel director "manages" his department which has a staff relation to the line executives, and that he does not "manage" the personnel.

A volume on personnel management would have been much more complete and the title would have been more appropriate if it had included a chapter on "Supervision and Discipline," which, despite the recent development of other phases of personnel administration, is still and always will be a very large part of man-management.

More Light on the Sales Letter

MAKING LETTERS PAY. *By Edward H. Schulze. 455 pp. D. Appleton and Company.*

REVIEWED BY EDWARD J. KILDUFF

Chairman, Department of Business English, New York University, School of Commerce, Accounts and Finance

Class Number
658.824 Sales Letters

EDWARD H. SCHULZE, the author of "Making Letters Pay," has been engaged for a number of years in the business of planning and writing sales-letters and sales-letter systems. He is also the originator of the "Schulze Making Letters Pay System," which is used by numerous business organizations and from which much of the material in its latest work has been taken. As a result of his activities, Mr Schulze is [illegible] known in his field. His new book will doubtless attract considerable attention.

"Making Letters Pay" is a volume of 418 pages of text matter, 311 pages of which are devoted to a discussion of how to produce successful sales letters. The remaining 107 pages treat in a rather brief manner of certain essential features of "Routine Correspondence," "Credits," and "Handling Collections Scientifically." The value of this book depends mainly therefore upon the material concerned with sales letters.

The chief impression left with the reviewer after he had read Mr. Schulze's book is that the information it gives is sound and practicable, and that it contains many good sales-letter ideas which, even if they may not be directly applicable to the reader's business, will suggest related ideas.

A feature of "Making Letters Pay" is that the author gives example after example of what to do and what not to do in writing sales letters. Since most of these illustrations are taken from his own experience, Mr. Schulze is able to give the "before and after taking" results.

To the business man, one of the most valuable chapters in the book is that entitled "Profiting by Past Experiences." In this chapter the author points out the fact that many organizations fail to keep proper records of the results of their sales letters and, hence, are unable to take advantage of their failures or successes. As Mr. Schulze says:

> The careful business man—or his equally progressive employee—can no longer afford to take such chances. Business success in the future will be built on the careful reckoning of costs. We must conserve our energies and our resources. So he plans letter D, for instance, by analyzing successful letters A, B, and C, taking the best of these as a basis on which to build the letter D. Or, again, he takes the three weakest letters he has ever written—letters X, Y, and Z—and in his new letter D carefully refrains from committing the same costly errors. He profits by past successes and failures. He chooses the weak spots and the strong spots and uses them as guide-post in planning a better road to success.

"Making Letters Pay" will be of interest and of value to every business man who writes sales letters and that means nearly every business man—for who does not write sales letters in these days?

C. P. A. ACCOUNTING. *By George Hillis Newlove. 3 Vols. The White Press Company, Inc.*

THIS is the second printing of a work whose avowed purposes are: first, to show C. P. A. candidates what is likely to be expected of them and to offer them an opportunity for further study on the particular points on which they are weak; and second, to incite the universities to offer post-graduate courses in accounting.

The first two volumes classify all the general accounting and auditing questions given in 335 C. P. A. examinations. The third volume is made up entirely of solutions of the problems set forth in the preceding volumes. Volume III is available in two styles of

binding sewed cloth for ordinary library use and loose-leaf post-binder for use in schools. Students are, of course, expected to have access to Volume III only after they have themselves worked out the problems and handed in their solutions.

Dr. Newlove has attempted to cite at least three references for each point of accounting theory or practice brought out. As the giving of credit for direct quotations in the regular way would be impracticable he has devised an ingenious system of specific page references to the many accounting authorities from whose writings the quotations are made.

The courage on which this publishing project is based is apparently being rewarded by success. One factor in the favorable outcome is a practical monopoly of the field. The publishers claim that they have no competition, and it would be very difficult to convince an intelligent jury that such is not the case.

PROFITABLE MANAGEMENT. *By J. Lee Nicholson. 177 pp. The Ronald Press Company.*

THE author of this big little book is too experienced an accountant and a writer to be anything but frank about its plan and purpose. He has 117 pages in which to cover a subject which might be given 117,000 pages without undue repetition of ideas. He is therefore wise to announce in his preface that "there is no attempt to cover the entire field of improvement in methods, or even to make the book complete; dominant factors only are stressed, and the illustrations used are the simplest."

The preface, incidentally, contains a few sentences which might well be framed and hung on the wall of many executives' offices, so succinctly do they suggest the method and aim of modern business:

> Certain elements are vital to successful management. If they are lacking, the fate of the business depends on mere guess or chance; if they are present and properly coordinated, the business is brought under control. And the result of control is profit.

Chapter I, the shortest in the book, is on "Business Failures." Having rattled the bones of the skeleton, Mr. Nicholson gets down to cases in Chapter II on "Organization" and still more definitely in Chapter III on "Budgetary Control." The next chapter deals with the conservation of invested capital, and is followed by two on the control of production and of production costs. "Labor" is a rather large topic to be covered in a chapter of 12 pages, but the author indicates the "high lights" and trusts the reader to fill in the background detail for himself.

Chapter VIII on "Uniform Cost-finding Methods" covers a part of the management field that is "home grounds" for Mr. Nicholson, whose reputation as a cost specialist is international. The concluding chapters are on "Marketing the Product," "Operating Inventories," and "Mercantile Business." An Appendix carries a brief bibliography, divided into two classes, one dealing with industrial management generally and the other with cost accounting specifically.

This is [illegible] good cheer [illegible] appraise his own [illegible] developing it [illegible] and making it is admirably designed [illegible] man who must read as he runs. Some of [illegible] do most of their reading in exactly that [illegible].

TRADE ASSOCIATION ACTIVITIES. *By E. E. Warfi[illegible] and Richard A. Me[illegible], with introduction by Herbert Hoover. [illegible] pp. United States Department of Commerce.*

THIS useful volume, bearing the imprint of the Government Printing Office, constitutes the first attempt on the part of the Department of Commerce to describe the constructive activities of trade associations.

In his introduction Secretary Hoover quotes the definition formulated by the American Trade Association Executives:

> A trade association is an organization of producers or distributors of a commodity or service upon a mutual basis for the purpose of promoting the business of its branch of industry or commerce and improving its service to the public. Among the methods now in use for accomplishing this end are the compilation and distribution of information, the establishment of trade standards, and the co-operative handling of problems common to the production or distribution of the commodity or service with which they are concerned.

After a general statement concerning the activities of trade associations, Secretary Hoover takes up the compilation and use of statistics, legislative activities of the associations, simplification and standardization, cost accounting, credits and collections, trade disputes and ethics, employee relations, insurance, public relations, traffic and transportation, commercial and industrial research, and government relations.

Concluding his introduction, the Secretary says:

> The constructive purposes of trade associations have unfortunately been confused with the minority of activities which have been used as a cloak for action against public interest. It is also true that a vast amount of action in public interest has been lost and even great national calamities brought upon us by lack of co-operative action. All who know the situation in such matters realize that the problems of co-operative action are mainly the concern of smaller businesses. The material in this book has been brought together not from the point of view of educating big business, but with the idea that the legitimate trade associations and other forms of business co-operation are the real basis for promotion of smaller businesses.
>
> If we are to have a comprehensive economic system it seems to me that the time has come when we should take cognizance of the necessities. The growing complexity of our industrial life, its shift of objective and service, requires the determination of an economic system based upon a proper sense of rightful co-operation, maintenance of long-view competition, individual initiative, business stability and public interest.

The divisons of the book follow in general, the outline of topics indicated in Secretary Hoover's introduction. The material is provided by a large number of specialists, and is well edited and arranged by L. E. Warford and Richard A. May, under the direction of Julius Klein, Director of the Bureau of Foreign and Domestic Commerce. The sections dealing with the government are, as would be expected, especially complete and comprehensive. Altogether, this is a book worth many times the modest price charged for it. Many executives will want to have it on their desks or within easy reach.

STATISTICS AND THEIR APPLICATION TO COMMERCE. *By A. Lester Boddington. 315 pp. H. F. L. (Publishers) Ltd.*

THIS is a revised and enlarged edition of a work originally published in 1921 and well received on both sides of the Atlantic. Mr. Boddington's broadened experience as a commercial statistician and a lecturer on statistical method is reflected in this second edition, which is a credit to its more or less anonymous English publishers as well as to its author.

The work is in two main divisions, the first having to do with the compilation of statistical data and the second with the presentation and uses of such data. After an introductory chapter which urges the importance of business statistics, Mr. Boddington attacks the problem of compiling data, by the direct method, the questionnaire, and by use of published statistics. Here, and continually throughout the book, the author emphasizes the importance of trustworthy sources, asserting that "a smaller number of correct figures will enable a more accurate estimate to be made than a larger number of incorrect ones." Chapter III deals with accuracy, approximation and the various forms of error that continually present themselves to the user of any kind of statistics. Chapter IV, on averages and types, completes the first section of the book.

The second section begins with a chapter on tabulation, and then proceeds to describe the graphic method of presentation, methods of comparison, index numbers, correlation, and mechanical aids to statistical work. There are also two chapters composed of material which appeared in the columns of *Business Organization and Management*, one on "The Census as an Aid to Scientific Business," and the other on "Business Research."

The chapter on the census presents material that heretofore has not been particularly stressed by the business statisticians. It outlines the various kinds of information that are obtainable from the census, urges the value of census statistics to the business man, and discusses such topics as the density of population as affecting sales possibilities, the per capita consumption of commodities, occupational lists and labor supply, and the localization of industries.

In the chapter on business research the author indicates the profit-earning possibilities of research work, the qualifications of a worker in that field, and shows how the research specialist is related to both the producing and the selling divisions of an enterprise.

This is a solid, workmanlike piece of book making done soberly and conscientiously in the best English manner. It is no book of funny stories, nor is it intended to be. The reviewer did get one pleasurable thrill, however, when he came suddenly around a corner in Chapter VIII on "Methods of Comparison" and discovered *Skewness*. Getting acquainted by means of the First Measure and Co-efficient of Skewness, he advanced to the second and third degrees of the same, arriving finally at a beautifully complicated formula in which Skewness stood revealed in all its grandeur. "This calculation," says Mr. Boddington, repeating himself slightly, "requires considerable calculation." Nothing remains but to agree—it requires *considerable* calculation.

A PUNCHED CARD SYSTEM OF INVENTORY CONTROL. *By W. V. Davidson. 18 pp. The National Association of Cost Accountants.*

THIS is one of the most useful publications yet issued by the National Association of Cost Accountants. It describes a unique method of inventory control, accounting and billing, giving details of an actual installation. The system is based upon the use of tabulating machine cards, and while the special installation described concerned a chain of grocery stores, the method is applicable also to a variety of lines of business, such as assembling types of manufacturing, gas and electric utilities, fire and life insurance, motion-picture distribution and some forms of stock brokerage. It applies to these activities because each of them is built up on the basis of standardized unit transactions.

The central ideas of the installation, Mr. Davidson reports, were to punch tabulating cards for all shipping units of merchandise received; to set these cards up in files as the perpetual inventory of goods on hand; to apply the store orders against this file; to withdraw a card for each shipping unit ordered; to place the punched tabulating cards in the hopper of a tabulator and create a duplicate store invoice and warehouse selecting record, and then to use the cards for general mark-up analysis and store analysis.

As relatively minor features automatic purchase signals were provided, with records of consumption, warehouse turnover, and merchandise delinquency. The four major objects of the system, as stated by the author, are purchase, warehouse, state and profit control. These objects have been attained by the use of two chief devices; a pre-punched perpetual inventory of tabulating cards and the automatic creation of billing, warehouse selection and statistical records by means of mechanical tabulation. Results claimed for the system are:

1. Completeness of vital information.
2. Dominating control.
3. Accuracy and immediacy.
4. Simplicity and clerical economy.

MANAGEMENT DATA

Standardized Methods and Accepted Practice Classified for Permanent Reference

Number 19

CALCULATION, DISTRIBUTION, AND APPLICATION OF BURDEN

Steps in Burden Procedure

By GOULD L. HARRIS

Assistant Secretary, National Association of Cost Accountants; Assistant Professor of Management, New York University

Class Number
657.524 Cost Accounting

PROGRESSIVE cost accountants favor calculating and applying overhead or burden by the use of predetermined or standard departmental burden rates. An outline of this procedure follows:

1. Determining normal capacity for direct or producing departments and business as a whole.
2. Determining normal expenses and burdens for normal capacity.
3. Predetermining standard departmental burden rates.
4. Selecting equitable bases for distribution of overhead to expense and burden accounts.
5. Current charging, through monthly journal entries, of actual burden incurred to expense and burden accounts.
6. Current closing, through monthly journal entries, of primary expense accounts into secondary expense accounts, which in turn are closed into departmental burden accounts, one departmental burden account being kept for each productive department.
7. Preparing monthly expense and burden statements.
8. Applying standard departmental burden rates which charge Work in Process Burden accounts and credit Burden Credit accounts. The detailed charges for applied burden are entered on individual part cost sheets or assembly cost sheets as the case may be.
9. Transferring the burden balance of each productive department—which is the overabsorbed or underabsorbed burden—to Profit and Loss account.
10. Recording net result of this summary account in current Profit and Loss account as a deduction from or addition to gross profit as the case may be before net manufacturing profit is ascertained.
11. Preparing statements which show monthly comparisons of burden.
12. Revising departmental burden rates when standard burden rates are no longer applicable to current conditions.

Space will not permit treatment of all of these steps but most of them will be discussed.

Normal capacity, of course, varies for different departments and different industries but, generally speaking, is regarded as from 80 to 85 per cent of practical capacity. It cannot be expected that a plant will always operate at practical capacity, but 80–85 per cent of practical capacity would be considered a good rate of operation.

Why Normal Rates Are Used

A pertinent question is: Why use normal or standard rates? The futility of loading all the burden in a given period on subnormal production has been recognized for some time. If actual burden were always charged to current production, either one of two things might happen. If production were plus normal, the actual burden would be relatively low, provided the concern had not reached the point of diminishing returns, because there would be certain burden items that would be fixed and would not vary directly with changes in the volume of production. Therefore, the unit costs would be relatively low because there would be a relatively large number of units of product over which to distribute burden. Selling prices based on these low costs, when production is plus normal, would not enable the concern to build up substantial enough reserves for a rainy day. Conversely, if production was very low, unit costs would be very high. Selling prices based upon relatively high costs would not bring in business and the manufacturer would simply accentuate his idle condition. Therefore, selling prices, ordinarily, should be based upon standard costs, provided the manufacturer is not simply using the competitive market prices in establishing selling prices.

Before some burden items are collected in departmental burden statements for productive or direct departments, they pass through intermediate primary and secondary expense accounts, such as steam, compressed

air, electric power, etc. To be sure, some items like indirect material, repairs, etc., may be charged directly into these departmental burden statements. All burden ultimately must come to rest in some departmental burden statement.

Before expense and burden can be handled properly, a code of standing orders must be adopted for each indirect or service department and for each direct or producing department. Firms frequently prepare a booklet containing the standing orders code. The same code number should be used for the same kind of expenditure in every department so that a consolidated burden statement of all departments may be prepared. While some departments may incur certain expenses that others do not, these cases do not make it impossible to prepare a consolidated statement because after certain standing orders there will be no amounts recorded—the spaces being left blank.

Bases of Distribution

Rent. When a company rents a plant, it should obtain from owners detailed valuation of the various buildings occupied. This information is of value in prorating the rental charge. In many cases the proration is made to departments on the basis of square feet of areas occupied, considering that certain areas are more valuable than others. Some concerns use cubic feet as a basis, but this factor is not the only one to consider, for instance, a foundry, with a high roof, does not cost as much as a three-story building of the equal height. The square-foot basis, generally speaking, is satisfactory in distributing rent to departments.

Fire Insurance. If a company belongs to a factory mutual company, its insurance rates are apt to be low, and consequently the insurance may be charged to general manufacturing expense. But if it is not a member of such a mutual company, and insurance rates are high, then cost of premiums may be distributed to departments on the basis of valuations made for insurance purposes.

Insurance is usually taken out separately on buildings, equipment, and inventories, and if possible, should be distributed to these divisions of assets. If it cannot be traced to them, then it should be distributed on the basis of the percentage that each class of assets bears to total of all assets.

Liability and Compensation Insurance. Liability and compensation premiums and rates are based upon amount of pay-roll paid out and hazards of the various operations. Premiums are estimates, and are paid in advance, being adjusted quarterly to the actual payrolls. Where occupations are similar, as in the small plant, the insurance charge per department may be made on a per man basis according to the number of men in the department.

Taxes. Where a company owns its plants, distribution of taxes on buildings is made in much the same manner as rent, when the taxes are large. If small, they may be treated as a general manufacturing expense, which is apt to be the case when plants are outside the high tax areas. Taxes on personal property should be distributed to departments upon the basis of the respective values of the equipment concerned.

Depreciation. Unquestionably, depreciation may be handled most satisfactorily if a plant equipment ledger or plant asset record is operated. The depreciation of buildings and equipment should be treated separately in the accounts.

Depreciation rates, used for the different classes of equipment will, of course, vary. Depreciation on building values is distributed to the various departments upon basis of relative value of the floor area occupied by each department. Depreciation on the section of the building devoted to the general superintendent's office, etc., should be charged to "General Manufacturing Expense." Mortality tables, or tables of depreciation rates, have been adopted by some trade associations which have uniform cost systems.

Most accountants favor the straight-line method of handling depreciation. In order to tie in all costs, depreciation on the cost records should be the same as that figured for government taxes. Otherwise adjustments will have to be made at the end of the year.

Steam Expense. Steam is used to run steam engines in the power plant, to heat office buildings, and for manufacturing processes. Consequently, some of the steam expense is distributed to the Electric Power account and the rest to the General Manufacturing Expense account. The distribution should preferably be made from the readings of flow meters showing steam consumption. If such meters have not been installed, the chief engineer or master mechanic should prepare estimates as accurately as possible as to the steam that each department will use. The estimates are then used in making the distribution of steam expense.

Power. While the use of meters is the most scientific way to measure departmental consumption of kilowatt hours, nevertheless, probably a large majority of concerns are using horse-power ratings because of the expense of installing meters and the small variation in power consumption between different departments found to exist in some plants.

Too many concerns make entirely too detailed distribution of power costs, particularly where power cost is comparatively small in amount. Here is a splendid opportunity for cost simplification.

Handling of General Manufacturing Expense

General Manufacturing Expenses. Whenever possible without too much detailed costing, items should be kept out of the General Manufacturing Expense account and entered in segregated expense accounts, such as purchasing department, pay-roll department, cost department, general superintendent's office, etc. The General Manufacturing Expense account is usually the last one to be prorated to direct or producing departments.

In the past it has been rather common to distribute this expense to departmental burden accounts on the basis of the respective direct-labor cost of each direct department. This basis is erroneous because the expense is incurred as much for the benefit of indirect as for direct labor. Therefore, total labor (direct and indirect) hours, total labor (direct and indirect) cost,

or the total number of men are more accurate bases to use.

General manufacturing expenses are distributed according to the ratio that the total pay-roll of each direct or producing department bears to the total pay-rolls of all the direct or producing departments.

When many departments operate at normal capacity, it may be unfair to distribute all of the general manufacturing expenses according to the above bases. For that reason this expense may be distributed upon the basis of a standard charge per dollar of total pay-roll based upon normal capacity throughout the plant. This standard charge is determined by dividing total normal general manufacturing expense by total normal pay-roll. This charge is then applied to total pay-roll of each department to get the share of general manufacturing expense to be borne by that department. Hours instead of dollars are sometimes used as a basis for such charging. Unabsorbed balance of general manufacturing expense is closed into unabsorbed burden for the whole plant.

Burden Accounting Procedure

Standard Burden. Three other questions relating to burden will now be considered:

1. Length of time to be considered in arriving at standard burden rates as well as standard labor and material costs.
2. Method of recording unearned or overearned burden, as the case may be.
3. Frequency and method of writing off the difference between standard burden and actual burden.

There are two points of view with respect to the first problem. One is to use the fiscal year in setting predetermined burden rates; the other is to use a cycle of years.

In booking the difference between standard and actual burden, two accounts may be set up for it, one called "Burden Variance," and the other, "Unearned and Overearned Burden." The former shows the difference between the estimated and the actual burden; the latter, the difference between the estimated burden and the burden applied at predetermined standard rates.

Some cost men contend that keeping these two accounts for the difference complicates the bookkeeping, and that the difference can be analyzed well enough by simply setting up one account—the Unearned and Overearned Burden account.

The usual practice is to write off to Profit and Loss the differences between burden applied at standard rates and actual burden, at the end of the year instead of each month, because an underabsorption one month may be offset by an overabsorption the next month. Still, some cost men contend that the most scientific way of handling these differences is through a Reserve for Overhead account; the business cycle, rather than the fiscal year, being considered in setting up the reserve.

In applying burden, normal burden is divided by the burden basis in a normal period to get the predetermined burden rate—burden rates, as stated before, being arrived at for each direct or productive department. These rates are then applied to the job, product or operation, etc., depending on the type of cost system in use, in a current period, to get detailed burden applied or earned, according to burden basis selected. This burden is shown in the burden statement for each department, together with the actual burden which is segregated opposite the standing orders. The total burden applied for all departments is charged to a Work in Process Burden account or simply to the Work in Process account. The burden credits are made to Burden Applied or Burden Credit accounts.

Methods of Applying Burden

The advantages and disadvantages of the different methods of applying burden will now be discussed:

Direct-Labor Cost Method. This method is simplest and easiest to operate because pay-rolls must be prepared and labor costs can be easily secured for burden purposes. The method is serviceable where production is uniform and continuous, where labor is the chief factor, and where wages are fairly uniform.

But the advantage of knowing elapsed time for scheduling and planning purposes is lost under this method. It is not suitable where production is fluctuating and seasonable, where wages paid on the same class of work are not uniform—in this case the product of workers earning a bonus being penalized—and where bench work and machine work are performed in the same department.

The severest criticism of the method, however, is that it is based on cost rather than time, and burden bears more of a relationship to time consumed than to labor cost.

Direct-Labor Hours Method. The direct-labor hours method, however, is based upon time, which is the chief reason for its accuracy. It is a simple method to use where production is uniform. Disadvantages of the method are small when compared to the advantages. The method may be inaccurate where machine and bench work are performed in the same department, and where production fluctuates.

Machine-Hour Rate Method. In modern plants technical processes are intricate and complex. Homogeneous operations are limited to small areas. Machines and equipment are vastly different, and each machine or group of similar machines in one department affords a natural rather than an artificial unit for the incidence of burden, provided machinery is the chief factor in production, also the quantity of production is large.

While there is considerable detailed work involved in first arriving at machine rates, thereafter the machine rate method is easy to apply. There is no question, however, but that the machine rate has been overdone, and the detailed work in determining the rates in many cases has not been justified. If the machine rate records are not carefully kept, ridiculous inaccuracies result. Another disadvantage raised against the method is that it is not applicable where machine work and bench work are done in the same department

MANAGEMENT AND ADMINISTRATION

FOR OFFICERS EXECUTIVES AND DIRECTORS OF INDUSTRY

MEN MATERIALS MACHINES

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Borrowing from Your Bank

By STUART H. PATTERSON

Comptroller, Guaranty Trust Company of New York

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332.1 Banking
658.14 Business Finance

To secure closer co-operation between the bank and the business executive, it appears to be worth while to present in direct, non-technical language, the fundamental requirements for closer relationship between these two important factors in modern business.

In its simplest function the bank, chartered by the National Government or by a state, accepts the deposit of money from individuals, firms, and corporations, subject to their check, and then lends out the funds during the period when they are not required by the depositors. A trust company performs substantially all the functions of a bank except that it does not have the right to issue money in the form of bank notes.

Among the ordinary services rendered by banks to their depositors are the collection of checks, drafts, and coupons, and the payment of checks drawn by depositors as they expend their money. To render these services it is necessary for the bank to keep adequate records, necessitating the employment of many officers and clerks and involving various expenses which the bank must earn by loaning out the deposits in its possession. In a word, the bank affords depositors a cheap and safe way of transacting their financial affairs, and as compensation has the use of the money while it is on deposit.

Another principal function of a bank is the loaning of money, and while this may appear to be a simple matter it is really a business transaction that is surrounded by endless complications.

In the first place, the bank must always have money available when depositors wish to draw it out. One safeguard imposed by the law in this respect is that the banks must carry a certain percentage of its deposits in a reserve account. Members of the federal reserve system must carry their reserve accounts with a federal reserve bank, and the banks derive no income from this reserve. The reserve is, however, only a partial measure. In addition the bank must keep its other funds liquid in case depositors wish to withdraw beyond the amount carried in reserve.

A bank's first duty is to its depositors. It must be able to meet any call, at any time. One means of keeping its resources liquid is to confine the greater portion of its loans to notes eligible for rediscount with the federal reserve bank. Another means is so to arrange its loans that the maturities come on dates evenly distributed throughout the year, thus insuring that a certain amount of ready money may be depended upon to come in daily. Still another method is to arrange that the maturities shall come at periods of the year when withdrawals by depositors are the heaviest.

To keep this machinery working smoothly, the bank must know that loans will be paid at maturity. In many instances, of course, loans are renewed, but this is in effect a new arrangement into which the bank may decline to enter if it has made other commitments of its funds. Therefore, a borrower should always be prepared to pay his loan at maturity.

In order that the bank may apportion its loaning funds out equitably among its customers, and that the borrower may arrange his affairs with the understanding that in normal times there will be money available for him, it is customary for many banks to give a borrower a line of credit available for a year, although some banks feel that a borrower should pay off all of his loans with the bank at least once a year. This line of credit is not a definite commitment to lend a given amount of money to a borrower. It simply means that the bank, after careful investigation, feels that it can with safety lend a stated amount of money to the borrower during the year, if he desires it. It also implies that the bank considers that the customer has been keeping sufficient deposits with the bank to entitle him to the use of such an amount of money.

Some loans are secured and some are unsecured so far as the physical deposit of collateral with the bank is concerned, although there is always security of some kind to insure its payment; otherwise the loan would not be made. However, it is not always necessary or practical to deposit the collateral with the bank. When a loan is made without such deposit, it is known as a "clean" loan.

While custom and the character of the business dictate in a general way whether a loan shall be secured or "clean," in the final analysis it is the honesty of the individual or corporation that secures the "clean" loan, or any other kind of loan, for that matter. No matter what the nature of the business may be, a bank will not lend money if it has doubt of the integrity of the borrower, or of his ability to repay.

A man on a small salary may need to borrow money because of sickness or other misfortune. If his honesty and integrity are well established, and if he can promise to repay it in a prescribed time, a bank would be justified in loaning him a moderate amount on his note without collateral. On the other hand, practice requires that when stock brokers, for example, borrow from banks they must pledge collateral with ample margin, irrespective of their wealth and integrity, because of the possible rapid fluctuation in the market prices.

In some cases a bank may feel that it can with safety grant a concern a clean loan up to a certain amount, and a secured loan for anything over that figure.

Propriety of Borrowing

Some people have a horror of debt, and others try to borrow more than they should, but there is a happy medium which is essential for the transaction of business. If there were no loans, banks would not have the income necessary for operation, and there would be no banks.

In the average business there are certain seasons of the year when more money is required than at other seasons. If an amount of capital were provided so that it would never be necessary to borrow money, there would be certain seasons of the year when idle money would accumulate. With such enterprises it is usually desirable to proportion their capital to their requirements in normal times, and then to borrow money during the seasons when larger funds are required.

Certain concerns never have enough capital, and are therefore continuous borrowers. This course may answer for a while, but if money gets scarce these concerns are likely to find that they cannot renew their loans, and such a course may end in receivership.

A certain amount of borrowing for legitimate purposes indicates a healthy condition of business. It is well known that money piles up in banks during periods of poor business, and bond prices advance because of the greater demand for bonds for investment purposes; while, during periods of business activity when there is an increased demand for money, bond prices are likely to decline.

Moderate borrowing, then, denotes a healthy condition of business. But if it becomes excessive, it produces inflation which usually precedes a period of business depression.

Dread of Interview with Bank Officers

Possibly as a result of tradition, some men stand in awe of their bank and maintain no more contact with it than is absolutely necessary. Others have the impression that the bank is out to extract the last possible cent from those who need to borrow money, and feel that the less they have to do with banking institutions the better off they are. Both attitudes are wrong.

There may be some banks that are not as progressive as they should be, but keen competition has gradually created a different atmosphere in modern banks. They are glad to co-operate with customers in working out problems when the customers are willing to put the facts frankly before their bankers. Fundamentally, all banks can do the same class of business, and hence one bank should be able to serve its customers as well as another. Consequently a bank's only arguments to attract business are its soundness, its broad-minded policy in dealing with customers, its ability to render the best possible service, and the intelligence and courtesy of its officers and clerks.

When you go to interview a bank officer about a loan keep firmly in mind the fact that the bank *must* make money. Out of what it charges for interest on loans it must pay all of its operating expenses, and taxes; must earn a return on the invested capital, and if it pays interest on deposits must also earn funds for this purpose. It must also set aside a reserve to cover bad debts contracted in the course of business. (There are very few businesses that do not have some bad debts, and a bank is no exception to the rule, no matter how careful its officers may be.)

Naturally, the average man prefers to deposit his money with a bank that is making money, and the ideal situation is for a depositor to own some stock of his bank, if only a share or two so that he may share in the prosperity which he himself helps to create.

Remember that a bank is just as desirous of lending money, providing it can do so safely and at a fair rate, as a customer is to borrow it. If the borrower can safely and profitably use the money there is no reason why he should not borrow in moderation and in accordance with his circumstances. In fact there is every reason why a customer should interview his bank on the subject, as the bank cannot well approach its clients and ask them to borrow money.

This is not an argument for promiscuous borrowing. It is merely a suggestion to the man who may be unduly cramping his business rather than ask for a loan which may both help him and, at the same time, be good business for his bank.

Bank Interested in Success of Depositors

A bank is interested in the success of its depositors because as their business grows it produces increased business for the bank. Customers should consult freely with the bank officers if for no other reason than that they are jointly interested in the success of the business.

A man may be an expert in manufacturing and selling goods, but may have only a limited knowledge of financial matters. On the other hand, bank officials are not only trained in financial matters but through constant intercourse with all kinds of business are also well versed in commercial matters. If the business man will only view the matter in the right way he can secure the highly specialized services of trained men, merely by laying his problems honestly before his banker. If the advice is contrary to the inclinations of the customer it is but just to remember that it is because the bank desires to see the business conducted on a safe basis. Surely the customer desires safety above everything else—otherwise he may lose his all.

The great majority of men are honest, whether they be farmers, storekeepers, or officers of corporations. Financial disaster comes not so often from dishonesty as from ignorance or incorrect information concerning business conditions and methods. Therefore, the very least a man can do is to draw on the knowledge of his banker to supply him with what he lacks in financial knowledge.

Even the proprietor of a small business should not be deterred from consulting his banker, as usually such a man is in more serious need of financial advice than are those engaged in larger operations, who may have had more extended experience in finance. No man, whether his business is large or small, should have any hesitancy concerning consultation with his bankers. There are many cases on record where ultimate financial difficulties could have been avoided had the customer, in the early stages, taken his troubles up with his bank.

Inventories and Other Current Assets

In a careful analysis of the financial condition of a business, there is an important distinction between the amounts carried in inventories and good notes, and accounts receivable, as the latter can be realized on more quickly than the merchandise. Notes receivable can be discounted and frequently accounts receivable can be converted into notes receivable when a concern wishes to secure funds by discounting its notes receivable, while the inventory in a manufacturing business must be worked up into the finished product and sold. Furthermore, inventories require a constant investment of funds, while the receivables are more flexible, as they are available for discount.

Recently a review was made of a balance sheet of a company desiring to open a new banking account, to secure an additional line of credit. The percentage of the company's total current assets (including inventories) to current liabilities showed a satisfactory ratio, and yet the ratio of cash and accounts receivable to current liabilities was only 46 per cent. As a matter of fact a bank had for years been assisting this company in running its business by permanently supplying it with capital in the form of loans. These figures are here shown as of the "X Company."

Assets	X Company Actual Condition	A Safe Condition	Increase	Decrease
Cash	$340,510	$150,000		$190,510
Accounts Receivable	392,650	392,650		
	$733,160	$542,650		$190,510
Raw Material	1,775,500	1,775,500		
Goods in Process	945,300	945,300		
Finished Goods	410,800	410,800		
Total Current Assets	$3,864,760	$3,674,250		$190,510
Advances to Subsidiary Companies	995,000	200,000		775,000
Investments	215,000	1,010,000	$775,000	
Plant, Machinery, etc	5,850,000	5,850,000		
Office Building	450,000	450,000		
Total Assets	$11,374,760	$11,184,250		$190,510
Liabilities	**X Company Actual Condition**	**A Safe Condition**	**Increase**	**Decrease**
Accounts Payable	$45,853	$45,853		
Banks Loans	1,550,000	400,000		$1,150,000
Total Current Liabilities	$1,595,853	$445,853		$1,150,000
Mortgage on Building	225,000	225,000		
First Preferred Stock	2,000,000	4,500,000	$500,000	
Second Preferred Stock	2,000,000			
Common Stock	4,000,000	4,500,000	500,000	
Surplus	1,553,907	1,513,397		40,510
Total Liabilities	$11,374,760	$11,184,250		$190,510
Ratio to Current Liabilities of:				
Cash and Accounts Receivable	46 Per Cent	121 Per Cent		
Current Assets	242 Per Cent	824 Per Cent		

The average business man might not see anything very alarming in the foregoing. In fact he might feel well satisfied with it, as the ratio of current assets is 2.42 times current liabilities. But if the company were called upon to pay its loans, it could not do so except by going into liquidation or securing additional capital. Furthermore, if prices advanced, it would require considerably increased funds to do business; that is, it would need more money to carry the same stock of goods and the same volume of accounts receivable.

The principal dangers indicated in this statement are:

1. That in the particular kind of business which it represents the large inventories shown must be

carried continuously, necessitating a permanent tie-up of capital for that purpose.

2. That the $995,000 shown represents advances to a subsidiary company, of which only $200,000 was for temporary seasonal borrowing, while the balance was permanently used by the subsidiary for operating purposes, this being a "frozen" loan.
3. That if prices should advance, the company would require more money to transact the same volume of business, and a bank would hesitate to make further advances to the X Company. In fact, it should already be urging the company to get in a more liquid condition.
4. That the company has outstanding too many classes of stock for a small company. The total amount authorized of each class has been issued. Both the first and second preferred stocks carry cumulative dividends, the second preferred being callable and the first preferred not callable and having equal voting power with the common, all of which makes a rather complicated structure for additional financing.

Looking at this matter entirely from the side of the X Company, if you were handling the finances of that company you would unquestionably feel more comfortable if you had more capital in the business, so that the loans would be less and the company in a better "quick cash" condition.

Watching and Testing Financial Condition

It is of vital importance that the owners of a business should know what its real condition is. One way of testing conditions is to have a balance sheet drawn up on a basis of what may be considered an ideal condition for the business and then from time to time compare the actual balance sheet with it to note the differences. As time goes on the owners should watch to see whether the condition of the business is improving or getting worse. This can be done by comparing the present balance sheet with those for earlier periods.

To illustrate this point more clearly, two examples are shown below. Table 1 represents a business whose condition has improved during the year; table 2 one whose condition has become worse.

In Table 1, a small amount has been expended for additional plant facilities and a distribution in the form of dividends has been made at the rate of 5 per cent on the capital, with the result that it was possible to reduce the amount of borrowed money by $23,000.

In Table 2, the plant cost has been increased by $50,000; dividends of 8 per cent have been paid amounting to $40,000; and the inventory has been increased $25,000. A continuation of such policy, without additional capital, or accumulated profits, is sure eventually to bring ruin to the business.

Many business men look upon their books of account as more or less of a nuisance instead of realizing that they can be made to reveal a true picture of what the business is doing, and can thus be regarded as a barometer which, properly studied, will reveal dangerous tendencies.

TABLE 1. COMPARATIVE BALANCE SHEETS, DECEMBER 31

Assets	1922	1921	Increase	Decrease
Cash	$45,000	$50,000		$5,000
Accounts Receivable	260,000	255,000	$5,000	
	$305,000	$305,000		
Inventory at Cost or Market whichever is lower	325,000	325,000		
Total Current Assets	$630,000	$630,000		
Plant Investment	280,000	275,000	$5,000	
Total Assets	$910,000	$905,000	$5,000	

Liabilities	1922	1921	Increase	Decrease
Accounts Payable	$100,000	$100,000		
Unpaid Wages	15,000	15,000		
Loans Payable	162,000	185,000		$23,000
Total Current Liabilities	$277,000	$300,000		$23,000
Capital	500,000	500,000		
Surplus	133,000	105,000	$28,000	
Total Liabilities	$910,000	$905,000	$5,000	

Ratio to Current Liabilities of:		
Cash and Accounts Receivable	108 Per Cent	100 Per Cent
Total Current Assets	224 Per Cent	210 Per Cent

Surplus Account

Credit balance at beginning of year	$105,000
Net profits for year	53,000
	$158,000
Dividends or profits distributed	25,000
Credit balance at end of year	$133,000

The resource and disposition statement shown above is a condensed summary of financial changes during a given period, and tells the story more clearly than a mere comparison of balance sheets can show it.

To prepare such a statement, the balance sheets at the beginning and the end of the period under consideration should be listed in two columns side by side, with two additional columns to note the increases and decreases in the assets and liabilities between the two dates. The *increases* in the liability accounts and *decreases* in the asset accounts represent the resources. The *increases* in the asset accounts and *decreases* in the liability accounts represent the disposition made of the resources and should be listed under the heading of disposition.

A further segregation should, however, be made in the Surplus account, which would appear among the resources, if it shows an increase during the given period. If, on the other hand, the Surplus account shows a decrease, it should appear among the disposition items. The principal changes in the Surplus account should be analyzed and the net earnings or net profits entered under resources in place of the amount representing the increase in the surplus and the amount of dividends paid and depreciation charged off. This analysis of the Surplus account is desirable so that the picture will show, on one side, the profits of the year, and, on the other side, the proportion of the profits used for dividends, depreciation, etc., and the amount added to the Surplus account.

When to Borrow for Inventories

Comment has been made regarding the undesirability of tying up borrowed money indefinitely in inventories, but this does not mean that a business should never borrow money for inventory purposes, as there are many lines of business in which the inventory is much larger at certain times of the year than at others, and it is perfectly right and proper to borrow to carry goods over the peak periods. That is a self-liquidating proposition and is very different from investing borrowed money permanently in inventory.

In addition to seasonable periods of high inventories, such as have been spoken of, there are also times when goods are unusually cheap and, if the element of time does not produce deterioration in value, it may be desirable to lay in sufficient stock to last a considerable period, such items as copper, pig iron, and other non-perishable commodities being in this class. The successful merchant or manufacturer is usually blessed with a certain amount of foresight which assists him in stocking up when goods are low and keeping his purchases at a minimum when goods are high. While certain other business men may not have this faculty so well developed, it would seem that when goods are selling at less than the cost of production in normal times (which occasionally happens) a business cannot go far wrong in laying in a sufficient supply to last a considerable period, providing there is sufficient money for the purpose. If not, it would be entirely reasonable and proper to discuss the situation with the bank, to see how much money it would be willing to lend for such a purpose and for how long a period.

The important point in a matter of this kind is to take it up with the bank and learn its views on the subject before entering into any extensive commitments, rather than go into them without proper financial arrangements and possibly later find that the bank is unwilling to make the loans necessary to carry the stock.

TABLE 2 COMPARATIVE BALANCE SHEETS, DECEMBER 31

ASSETS	1922	1921	INCREASE	DECREASE
Cash	$45,000	$50,000		$5,000
Accounts Receivable	260,000	255,000	$5,000	
	$305,000	$305,000		
Inventories at Cost or Market whichever is lower	350,000	325,000	$325,000	......
Total Current Assets	$655,000	$630,000	$25,000	
Plant Investment	325,000	275,000	50,000	......
Total Assets	$980,000	$905,000	$75,000	

LIABILITIES	1922	1921	INCREASE	DECREASE
Accounts Payable	$100,000	$110,000		
Unpaid Wages	15,000	15,000		
Loans Payable	247,000	185,000	$62,000	
Total Current Liabilities	$362,000	$300,000	$62,000	
Capital	500,000	500,000		
Surplus	118,000	105,000	13,000	
Total Liabilities	$980,000	$905,000	$75,000	

Ratio of Current Liabilities vs:		
Cash and Accounts Receivable	83 Per Cent	100 Per Cent
Total Current Assets	181 Per Cent	210 Per Cent

SURPLUS ACCOUNT

Credit Balance at beginning of year	$105,000
Net Profits for year	53,000
	$158,000
Dividends or Profits Distributed	40,000
Credit Balance at end of year	$118,000

STATEMENT OF RESOURCES FOR THE YEAR 1922 AND THE DISPOSITION MADE OF THEM

RESOURCES	TABLE 1	TABLE 2
Net profits for year	$53,000	$53,000
Increase in amount of borrowed money	0	62,000
Total resources	$53,000	$115,000

DISPOSITION OF RESOURCES	TABLE 1	TABLE 2
Dividends paid	$25,000	$40,000
Increase in plant account	5,000	50,000
Increase in inventory	0	25,000
Decrease in amount of borrowed money	23,000	0
Total as above	$53,000	$115,000

More Than One Bank Account

There are times when a bank must refuse to make a loan even though it is perfectly good in every respect because, as explained herein, a bank must always keep in a liquid condition, and it may not have money to put out at the time such loan is desired. Furthermore, it must deal fairly with all customers, and it would be hardly just to lend a considerable sum to some depositor who had never carried a large deposit account and because of such a loan to him, be unable to make a loan to some other depositor who had been maintaining a good account. When conditions are normal many banks figure that a depositor is entitled to borrow an amount equivalent to five times the average deposit maintained by him for some time past, providing of course that the loan itself is safe.

There are also certain legal restrictions as to the amount a bank can lend to any individual or corporation.

For these reasons, it is frequently advantageous for a business to have more than one bank account. If the capital and surplus of a local bank are small, a condition which naturally restricts the amount it can lend to any one concern, it may be desirable to carry another account in a large city; usually it is desirable to open such account through the introduction of the local bank, which should be in a position to give a satisfactory letter of introduction and supply the credit information required by the larger bank.

Information a Bank Desires When Granting Credit

In considering a line of credit for the average business a bank usually desires the following information:

1. Latest available balance sheet; also balance sheets for preceding years, if they are not already in possession of the bank. Accounts should be grouped on balance sheets to show the current assets and current liabilities separately from the other assets and liabilities. The items in the former group should include the accounts given in Table 3.
2. Statement of the manner of valuing goods in inventory. (Inventories should be at cost or market, whichever is lower.)
3. Amount of insurance carried on plant and the amount on merchandise.
4. Amount of notes and accounts receivable, past due or of doubtful value.

5. Statement of amount, if any, of notes receivable, accounts receivable, or merchandise pledged to secure indebtedness.
6. Amount of notes receivable under discount; also any other contingent liability, as endorser or otherwise.
7. Full and clear explanatory notes of all unusual items in balance sheet, to insure fair consideration of them by the bank. Otherwise the bank, in order to be on the safe side when there is ambiguous wording or lack of detailed explanation, will classify such an item as *slow* assets, if it is an asset, or among the *current* liabilities, if it is a liability.
8. Statement of any contemplated construction or capital expenditure during the year, and the means by which it will be financed.
9. Earnings statements and profit and loss statements for a period of at least three years. A simple and convenient universal form for this purpose is as follows:

COMPARATIVE EARNINGS STATEMENT

	YEAR *1923*	YEAR *1922*	YEAR *1921*
Sales or Earnings (Net)			
Less			
Cost of Goods Sold			
Depreciation			
Other Deductions			
Total Deductions			
Net Manufacturing or Trading Income			
Less			
Selling Expense			
Administration Expense			
Other Expenses			
Total			
Net Operating Income			
Other Income			
Net Before Interest			
Less			
Interest on Funded Debt			
Interest on Floating Debt			
Other charges			
Total			
Net Income Before Taxes			
Taxes			
Net Income Before Dividends			
Less			
Dividends on Preferred Stock			
Dividends on Common Stock			
Other Withdrawals			
Total			
Balance to Surplus			

PROFIT AND LOSS OR SURPLUS ACCOUNT

CREDITS	YEAR *1923*	YEAR *1922*	YEAR *1921*
Balance at beginning of year			
Earnings for year			
Other credits not applicable to operations for year			
Bad debts recovered			
Total Credits			
DEBITS			
Bad debts charged off			
Other losses or adjustments			
Total Debits			
Surplus as per balance sheet			

TABLE 3. SHOWS THE GROUPING OF ACCOUNTS UNDER CURRENT ASSETS AND CURRENT LIABILITIES

CURRENT ASSETS	CURRENT LIABILITIES
Cash in office and in banks	Notes payable—banks
Cash margin with banks	Notes payable—brokers
Cash deposits in foreign countries	Notes payable—for merchandise
Cash advanced for goods not invoiced	Accounts payable—due within one year from date of balance sheet
Cash in sinking fund to be utilized within one year	Pay-rolls due and accrued
Certificates of deposit with banks	Reserves for bad debts
Foreign exchange	Reserves for inventory losses
Notes receivable of customers	Reserves for contingencies
Accounts receivable of customers	Customers' deposits
Raw goods	Accrued interest payable
Goods in process	Dividends payable
Manufactured stock	Chattel mortgages
Goods in transit, if included in accounts payable	Notes or accounts payable to affiliated or associated companies
Goods on consignment	All other liabilities, the maturity of which is not specified, except capital stock
Government or municipal bonds	Bonds or mortgages maturing within one year
Other temporary investment if readily convertible into cash	
Accrued interest receivable	

10. Statement of amount of depreciation charged off and manner of computing it.
11. Explanation of any unusual condition in connection with the earnings; if they are more or less than normal, it is desirable to state reason and if earnings are low to state what steps, if any, are being taken to rectify the trouble.
12. A certification of the figures by independent auditors. (This is generally preferred by banks.)

The liquid condition of the business will be determined from the *balance sheet* and the *going concern* value studied from the Income account, which figures should show a steady earning power proportionate to the capital invested.

Kind of Business a Determining Factor

Aside from the figures, a bank should receive data indicating whether the business is a proprietorship, partnership, or corporation. The bank must also be able to form an estimate as to whether the men in charge are qualified for their positions from the standpoint of character, ability, and business record; and, if the business is a proprietorship or partnership, should know their personal financial status outside of the business. The kind of business also is a factor in determining the kind of loan, maturity date, possible endorsements, etc. The geographical location of a business is another factor to be considered, as climatic, economic, political, and financial conditions in various sections of the country differ widely and any of these conditions may have an important bearing on the soundness of the loan. The selling terms and the regularity with which business statements are issued are also important items to any bank which is considering making a loan.

Solving the Shipping Container Problem

Packing Methods Cut Cost and Prevent Damage and Loss

By B. L. HUESTIS

Engineer, Freight Container Bureau of the American Railway Association

Class Number
658.6884 Packing for shipment
658.68844 Containers

Lowering the cost of distribution is one of today's main industrial problems. A direct means toward its solution lies in designing proper containers and loading cars correctly. The national annual freight container bill is $500,000,000, while railroad damage claims largely because of poor packing total $18,000,000. Brought down to the individual plant, which the facts in this article make possible, methods of saving accomplish large economies. The E. S. Evans Co. reduced automobile export crate costs and damage losses $50,000,000 during the last 8 years. The Taylor Instrument Co. have saved half of their box bill. Brown and Sharpe Manufacturing Company have reduced crate costs 20 to 25 per cent and labor for crating 6 per cent.

IT is difficult to estimate with anything approaching accuracy what it costs all the shippers of the country, annually, to pack and prepare their output for shipment. However, a few figures will suffice for indicators of the tremendous total. During the year 1919, a year in which war production had practically ceased, and a period of business deflation was at hand, there were used in the United States boxes and crates having a value of $177,818,454, and barrels, kegs, etc., costing $46,624,549, or a total of $224,443,003. These figures cover only those containers which were made by regular container manufacturers. For 1923, the container bill will be nearer $500,000,000.

A number of items showing the distribution of this immense sum will be of interest. In 1922, the humble cranberry, as shipped in the United States, called for 525,000 barrels. Swift and Company alone, for packing their meats and other products, require 12,000,000 wooden boxes a year, using an average of 5 ft. of lumber per box. Box mills in the one town of Omak, in the Okanogan fruit district of Washington, are scheduled to make 5,000,000 apple boxes this year, costing the users a round million dollars. For the season of 1923-1924, the Florida citrus growers expect to use at least 18,000,000 wooden boxes, valued at close to $4,000,000. There are roughly 325,000,000 pairs of boots and shoes made annually in this country; of these about 78,000,000 pairs are shipped in wooden boxes. Allowing three dozen pairs to a box, this means 2,175,000 wooden boxes alone, which, at 80 cents each, would cost $1,740,000.

These figures might be quoted indefinitely but the point is soon reached at which the mind refuses to grasp their significance. The total is so vast that a saving of even a fraction of one per cent would be a huge sum.

In addition to the cost of the container, there are wrappers, labels, cartons, etc., and the large item of labor used in packing the boxes or crates. The combined cost of these items will often average more per container than the cost of the container itself.

After the container is packed, what does it cost to carry it to its destination? The gross operating revenue of the railroads of the United States for the year 1922, covering freight only, was $4,007,011,655. Added to this the railroads received $143,332,536 from the express companies. This latter figure, of course, does not represent all that the shipper had to pay, so that the total for the year was over $4,200,000,000. In the face of this staggering bill, it must be remembered that the figure quoted does not include water-transport, motor-trucking, or team delivery on freight. The railroad figure for the present year will run close to $5,000,000,000.

As a sidelight on the work done by the railroads in return for the shippers' money, records show that during the 37 weeks from July 1922 to March 1923, the railroads hauled 32,939,789 carloads of freight.

It would appear by this time that the shipping bill was quite large enough; but there remains to be considered the freight claim payment of $48,085,000 by the railroads in 1922. This figure, large though it is, represents a huge saving over the $96,730,000 payment made in 1921. For 1922, the amount actually charged to damage was $18,307,739, mostly due to poor containers.

To aid in cutting down this tremendous waste in industry due to loss and damage of ordinary merchandise in transit, the Freight Container Bureau of the American Railway Association was organized in 1921. The Association has classified all commodities into 33 distinct groups boots and shoes, household goods, furniture, etc. Expert engineers are assigned to the work, each to investigate one commodity at a time. The engineer studies the kind of containers used, the packing and shipping methods in vogue at individual plants, and the condition of the articles at unloading and transfer points. Tests are made on the various containers employed, and, finally, new designs are developed to render the most efficient service.

This work is all done in direct collaboration with manufacturers, shippers, consignees, crate- and box-

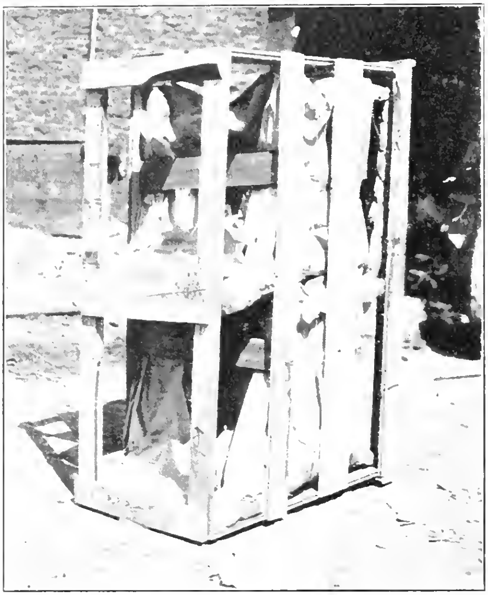


FIG. 1 TYPICAL EXAMPLE OF A POOR CRATE

makers and transportation companies, most of it being field investigations The information collected is published in pamphlet form as tentative recommendations, and is distributed to all interested parties. Proper designs, specifications, loading and shipping methods for the commodity in question are given. Criticisms are invited from manufacturers, trade organizations, transportation companies, and, if feasible, are incorporated in revisions of the pamphlets for the benefit of all who make, handle, or use the commodities.

For purposes of explanation the commodities themselves can be divided into four distinct classes, based on the strength requirements of their containers, as follows:

1. Return container products.
2. High value, easily damaged products.
3. High value, commodities not easily damaged.
4. Low value commodities.

Items in the first class, carried in steel oil-drums, express ice-boxes for strawberries, etc., require containers built to withstand the wear and tear of continued travel, and are not important factors in loss and damage, as compared with the other classes. Class 2 covers furniture, machinery, instruments, chinaware, etc. Class 3 includes shoes, dry-goods, package-groceries, etc. Class 4 takes in fresh fruits and vegetables, cheap glassware, bulk groceries, etc.

Beginning with class 2, then, we see in Fig. 1 a furniture crate which is typical of what crates have been generally. Note that old tongue-and-groove flooring has been used for this crate, and that many of the nails have been driven into the groove, thus reducing their effective penetration by a considerable amount. The lumber used is poor, and has been nailed together in a haphazard manner. Observe also that at the corners, the flat side of the upright is against the end of the horizontal piece along the edge of the top, showing that the nails used to fasten these two pieces together are driven into the *end-grain* of the wood in the horizontal piece.

If one were to place his hand against an upper corner of this crate, and push, the crate would give, or weave noticeably. In fact, the lack of rigidity in the entire crate is apparent at a glance. Such a crate depends entirely on the holding-power of a few nails to keep the parts not only from separating but from distortion. Injury to the enclosed furniture is very likely to occur, due to racking of the crate.

In Fig. 2 we have a crate which seems very well built, neat and substantial. This crate, solid as it looks, is nevertheless lacking in rigidity, and is a poor container for the uncovered bureau within.

Faults in Crate Construction

It will be seen that in both of the examples thus far shown practically all struts are parallel to or perpendicular to each other; in other words they form rectangles. The theory of structures shows the triangle to be the only rigid polygon, as it cannot change its shape unless one or more of its sides changes in length. Referring to Fig. 3, we see the use of diagonal braces for stiffening the crate. Note that each face of the crate on which diagonal braces have been used is roughly divided into triangular spaces. This is the same type of construction as that used on steel bridges, and the purpose is the same.

Diagonal braces may be applied in a variety of ways. They may be double, as in Fig. 3, or only one may be used on each face. They may be used on all faces, or omitted from some; steel straps may sometimes be used for diagonals instead of wood. Tests made by one of the engineers of the Freight Container Bureau show

FIG. 2 THIS CRATE IS HEAVY AND BADLY DESIGNED

the following relative values of different methods of applying diagonal bracing to crates:

1. The maximum load a crate can withstand if diagonals are used on only four faces of the crate, as compared with a crate having diagonals on all six faces, varies inversely as the ratio of the area of the faces from which the diagonals were omitted, to the total area of all six faces. While diagonals are not necessary on very small sides, or on sides very narrow in proportion to their length, they should be used on all other faces.
2. If diagonals are of the same size lumber as the frame members of the crate, the crate will be 15 per cent stronger if the diagonals are nailed to the wide side of a frame member than if nailed to the narrow side or edge; and if nailed to the wide side and the nails clinched, the advantage in strength runs up to about 60 per cent.
3. A crate even with diagonals nailed to the narrow side of frame members is *three-and-a-half times stronger* than a crate without diagonal braces.
4. Two metal strap diagonals per face, properly nailed at their ends, give greater strength than a single wooden diagonal against distortion due to racking.

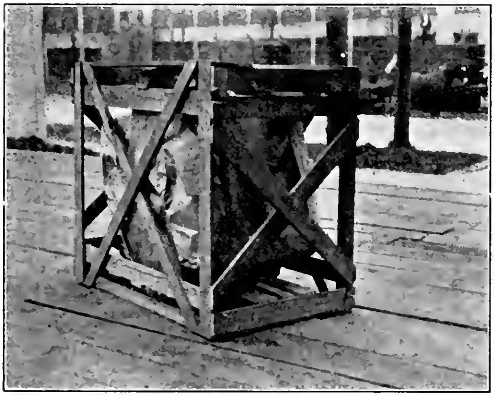


FIG. 3 A WELL-DESIGNED CRATE WITH THREE-WAY CORNERS AND DIAGONAL BRACES

5. A *single* metal strap diagonal per face is of *no value.*

Crates having two wooden diagonals on each face will be stronger and more rigid than if they had single diagonals, but the tests made did not determine the ratio.

There is one other vital principle in crate construction which is violated by the crates in Figs. 1 and 2. Nails driven into the end grain of wood, that is, parallel to the grain of the wood, are of little value, as they pull out very easily. This is of particular importance in the nailing of main members meeting at the crate corners. To develop maximum holding power, nails should always be driven at right angles to the line of the grain, or into "side grain," as it is called.

To permit of side grain nailing at crate corners, what is known as the "three-way corner" was devised. In Fig. 4 is shown at the left a typical three-way corner, as compared with a corner at the right

FIG. 4 COMPARISON OF GOOD AND BAD CRATE CORNERS

which is not "three-way." It will be seen that the three-way corner has all nailing driven into side grain, and that *each* piece is nailed to *both* of the others. This corner is found on the crate shown in Fig. 3. Compare this with the non-three-way corner, which is reproduced from Fig. 1.

There are sixteen possible ways of constructing a three-way corner.[1] In each, the three-way corner has *all* nails driven into side grain, and *each* member is nailed to *both* of the others.

If an article is being crated which requires protection against scratching of finished surfaces, or any other injury caused by some object entering between the frame members of the crate, it is not necessary to use many heavy slats as has been done in Fig. 2. The strongest lumber should be put into the crate-frame, and any additional protection secured by the use of intermediate slats of thinner wood, or by the use of sheets of plywood or thick veneer. Intermediate slats should be run across the shortest dimension of the face on which they are used; when this is done, thinner material may be used than when the slats run lengthwise of the crate, as the bending resistance of the shorter slats is the greater.

When crating furniture or similar commodities care must be taken not to place the piece so that it stands on its legs on the crate-bottom. It must be supported in its crate so that the legs or similar projections are free from strain, or breakage of the legs will almost certainly result. Whatever commodity is involved, it must be so braced that it cannot shift in the crate.

Wooden Boxes

The Forest Products Laboratory, the National Association of Box Manufacturers, and other organizations have prepared tables of thicknesses of box lumber and proper number and size of nails; a dependable and economical box may be constructed by the use of these tables. There are, however, a number of

[1] All of these are illustrated in "Technical Note No. 134," issued by the Forest Products Laboratory of the U. S. Forest Service, Madison, Wisconsin.

interesting features of wood-box construction, which may properly be emphasized.

In building a box, the weight of product to be packed in it is usually considered; but often the nature of the contents is as important as the weight. A 60 lb. box for canned fruit, largely syrup, must be constructed 50 per cent stronger than one containing 60 lb. of dried peas in cartons. If the two boxes are dropped, we have a "water hammer" effect in the syrup, while the cartons are, as it were, internally cushioned.

On a long box, or one containing bulk material in powdered form, nails are often driven through the edges of top and bottom into the sides. This is known as "side-nailing," and is employed to prevent gaping of the box on the long edges. It is a practice which should be avoided, as the nails usually soon split out of the top and bottom, increasing the chances of gaping. Bending inward can best be prevented by internal bracing, and bulging outward by the use of sealed strapping.

Boxes for class 2 or class 3 commodities, mentioned above, may be greatly strengthened by the use of metal strapping, which may be either nailed around the ends or, as is better for a long box, fastened with sealed strapping around it at one or more points along its length. Strapping usually permits the use of thinner lumber. Wire binding may often be used in place of strapping. Fig. 5 shows a box packed with canned goods, and fastened with one sealed strap around the center. This box was tossed about in a laboratory testing drum till it practically became a bundle of boards surrounding the cans as shown. In this condition the test was continued for a considerable time, yet the strap prevented any of the cans from falling out.

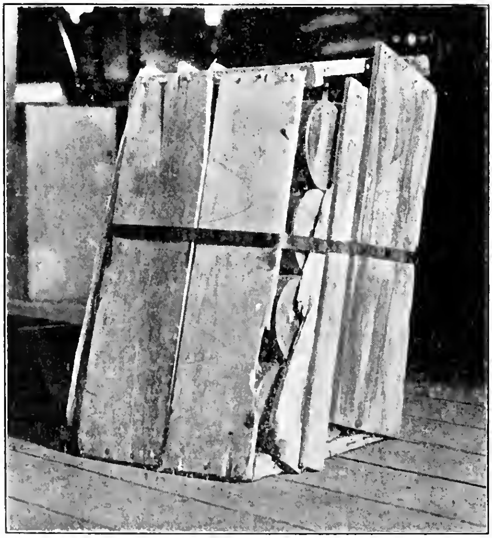


FIG. 5 A STRAPPED BOX AFTER TESTING

It frequently happens that a shipper, anxious to protect his product, uses very thick lumber in making up his boxes. This makes the box very rigid, and every shock received by the box is transmitted directly to the nails, so that such a box frequently fails by the nails pulling out. If the box-lumber were thinner, and hence more elastic, it would spring enough to absorb a considerable proportion of the impact. Naturally, the parts of the box must not deflect sufficiently to permit injury to the contents.

Whether or not strapping is used, and no matter how substantial the lumber, there is no substitute for the proper number of nails; just enough nails must be employed to hold the box firmly together. It is readily possible to drive too many nails, thus causing splitting of the parts. The fundamental principle of box building is that of balanced construction, that is, the strength of the nailed joints must be proportional to that of the lumber. A box so made is the most economical box that can be built.

Even with the proper design of the box and the use of sound lumber there is one final point to be observed.

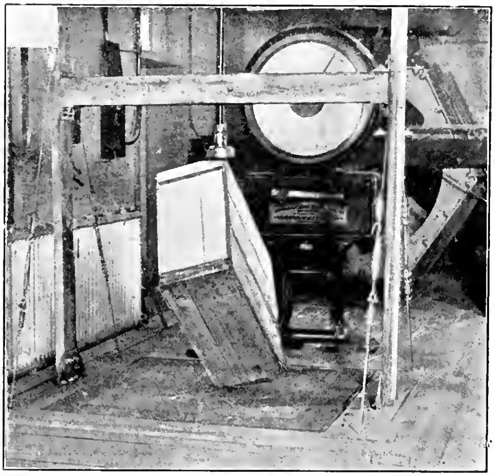


FIG. 6 THE DIAGONAL COMPRESSION TEST OF A BOX

The percentage of moisture in the wood is of great importance. If the wood is wet, the holding power of the nails is impaired. If it is too dry, it will be brittle and will split, or even break across the grain very easily. The condition which is most harmful is a wetting followed by drying, after the box is made up. This loosens nails and straps. On the average, box or crate lumber should be dried to between 15 and 20 per cent moisture content, based on the "totally dry" weight of the wood.

Wooden boxes carrying class 4, or low value commodities, such as fresh fruits or vegetables, can be strengthened by the same attention to wood, nailing, and balanced construction. They must be light and also cheap, which usually precludes strapping. Proper car loading avoids most of the damage.

Fiber Boxes

The use of solid fiber board, plyboard, or corrugated strawboard boxes for commodities of all classes is steadily increasing, as is to be expected from the rising price of lumber. An official of the Richmond, Fredericksburg & Potomac Railroad Company, which controls the important Potomac Transfer, near Alexandria, Va., recently estimated that two-thirds of the packaged commodities, exclusive of fruits and vegetables, handled through Potomac Transfer are in boxes of these types.

Such boxes, when properly sealed with good paper or cloth tape glued in place, or with metal stitching

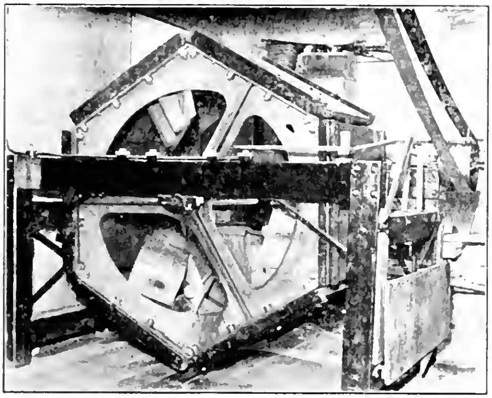


FIG. 7 A SIX-FOOT TESTING DRUM

or rivets, do not ordinarily fail at the point of closure. Failure is generally caused by tearing along a score on the edge of the box where the material has been bent, or else by puncture of the boxboard surface.

A well-made box of this type must be made of a pulpboard or strawboard of sufficient toughness to resist puncture, stiff enough to withstand crushing, and must have all joints well fastened with glue, silicate of soda, or metal fastenings. Glued or silicated joints must be held under pressure until the adhesive has set properly or the joint will be weak. Scoring to enable the edges or flaps of the box to be bent into position, must be wide and smoothly done to prevent cracking or breaking of the fibers when the bending is done.

Testing of Containers

Various tests have been devised for determining the serviceability of containers, and for the experimental development of superior types. Some of these tests are physical determinations of the actual properties of materials. Chief among these are determinations of moisture content, breaking strength of the wood, the holding-power of the nails, and bursting strength of plyboard and paper. The first and last of these are the only tests ordinarily made, as the properties of wood and nails have been fairly well worked out.

FIG. 8 THE INSIDE OF AN IMPROPERLY LOADED CAR

With regard to nails, it is interesting to note that cement coated nails (i. e., nails coated with a mixture of rosin and paraffin) have from 30 to 50 per cent more holding-power than plain nails, and that barbed nails have a much lower effectiveness than either.

The moisture content test is very easily made by weighing a 2 x 2 x 1 in. sample when first cut and then after thorough oven drying.

Determination of the bursting strength of plyboard is carried out by means of a special tester. A piece of fiberboard is clamped on the testing-table, and punctured by the expansion of a rubber diaphragm, actuated by hydrostatic pressure. Glycerin is the usual working fluid; the bursting pressure of the plyboard is read on an ordinary pressure-gage.

The principle series of commercial laboratory tests on boxes and crates are measures of the ability of the made-up container to resist injury. These tests are:

1. Diagonal compression.
2. Drop test.
3. Small drum.
4. Large drum.
5. Vibration.

In the diagonal compression test, the box or crate is placed with diagonally opposite corners between the compression points of the testing machine, and subjected to a slow, uniform increase of pressure. In Fig. 6 is shown a box being tested under diagonal compression. The machine illustrated is a platform scale with a motor-driven screw for applying the load. The loads required for successive eighths of an inch deflection of the container are recorded. This test closely parallels the stresses caused by high piling of containers in cars or storage.

The drop test produces results similar to the diagonal compression test, except that the results are obtained by impact. The container, fully packed, is suspended in a sling which holds one diagonal axis vertical, and with the lowest corner 12 ins. above a steel block. A special hook which carries the sling is tripped, allowing the container to fall on its corner on the steel block. The drops are repeated, so shifting the container in the sling that a different corner receives the impact for each drop, until all 8 corners have been tested. Successive series of drops are given at height increments of 6 ins., until the container fails. In all tests, a container is considered to have failed when it will no longer retain its contents.

Tests in the large and small drums are made to determine the amount of rough handling a container can withstand. The one shown in Fig. 7 is 6 ft. in diameter. A large 14-ft. drum is also used. These drums are built in the form of hexagonal prisms, and each of the 6 faces is equipped with a timber or metal "hazard" which causes the container to tumble successively on each face or corner as the drum slowly revolves. The number of falls which the packed container can endure is the measure of its serviceability. The small drum is used for small containers. The drum test is particularly useful for comparing experimental designs.

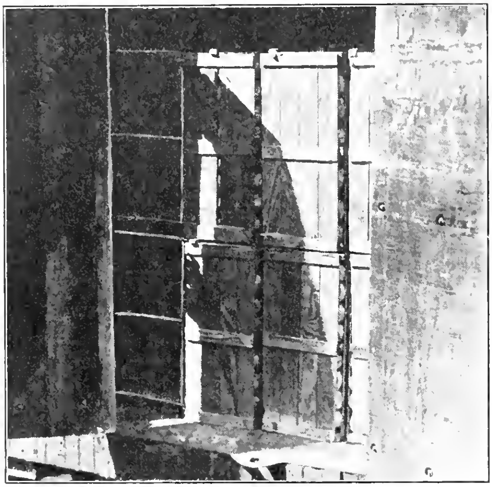


FIG. 9 A PROPERLY LOADED FREIGHT CAR

Method of Testing by Vibration

In the vibration test, the box or crate to be tested is placed, empty, upon the table of the testing machine, and so braced that it cannot slide about. A box containing several hundred pounds of sand is placed on the top of the container to be tested, and tied down to it. The machine table is on rollers, and is actuated by an eccentric, giving it a reciprocating motion of about 6 ins. The speed of reciprocation can be varied. This test subjects the container to a severe racking, and determines its relative rigidity; it simulates the placing of a box at the bottom of a load in a moving car. Of course, the test is usually more severe than actual shipping conditions; but it makes any lack of rigidity immediately apparent. The advantage of diagonal bracing for crates shows up strikingly.

Of tremendous importance to the safe carriage of a shipment is the method of loading it in the car. When a solid carload of uniform packages is being made up the cardinal principle is the avoidance of slack, or ability of the load to shift lengthwise of the car. A 4 in. loading margin is allowable, but heavy objects must not be allowed to crush lighter articles. Fig. 8 shows what occurred in a car owing to lack of bracing. Fig. 9 illustrates the way in which a solidly loaded car arrives when carefully braced and all unnecessary slack is taken up.

Does good packing pay? In view of the increasing cost of lumber, any saving which can be made in the amount of lumber used is desirable. The National Association of Box Manufacturers estimate that proper box and crate design would save 25 per cent of the box-lumber now being used; this would mean 1,500,000,000 bd. ft., worth $125,000,000. The individual experiences of a few well-known shippers with improved packing methods will be of interest.

Savings Made by Large Manufacturers

The E. S. Evans Company, automobile export-crate builders of Detroit, Michigan, have in the last 8 years effected a saving of $50,000,000, of which $17,000,000 represents elimination of damages and the remainder is divided between lumber savings, labor, and lessened freight charges on lighter crates. On one type of box designed for a single motor company, similar savings of $1,500,000 a year were effected.

The Taylor Instrument Companies of Rochester, New York, makers of thermometers and similar delicate instruments, have cut the cost of their boxes in half. They formerly had to use double boxes, but now fasten their instruments to a mounting board, and pack them in a single box of improved design which carries the product very satisfactorily. When the fragile nature of the commodity is considered, the modification of packing which better design has made possible, is even more notable.

The Brown and Sharpe Manufacturing Company of Providence, Rhode Island, ship a variety of goods weighing from a few ounces up to 7 tons. They have revised their packing according to modern methods, and have succeeded in reducing crating costs on machinery more than 20 per cent, packing on parts, etc., over 25 per cent, and labor, 6 per cent. They are still at work to better their packing, but their present annual saving runs into many thousands of dollars.

The Richardson & Boynton Company, furnace manufacturers, have adopted three-way corners, strapping, and similar improvements. While cost figures are not yet available, the reduction of damage to their heavy, bulky shipments has been significant.

It has already been pointed out that claims for damage in transit ran over $18,000,000 in 1922. This leaves a goal still unattained—the nearest possible approach to complete elimination of this figure. The immense savings possible in container construction offer another great opportunity. Will better packing be of benefit to your business? In the light of the figures already given the answer is not far to seek.

Estimating Monthly Collections of Cash

"How the Walworth Company Looks Ahead" Article Five

By JOSEPH H. BARBER

Staff Assistant to the President, Walworth Manufacturing Company

Preceding articles have described the monthly master budget with its advance notice of probable cash requirements. The present article explains the "prediction" or building up of a "collectibles fund" from which "with distinctly valuable accuracy" the treasurer can estimate in advance the amount of cash that will be at his disposal to meet these probable requirements.

THE previous article of the present series stated that the monthly master budget estimate "indicates the resulting cash conditions and gives the treasurer advance notice of probable cash requirements.

This value of the monthly estimate, though briefly touched upon there, is nevertheless one of the major values derived from the full procedure. The present article describes our methods of providing the treasurer with fairly accurate advance information as to the cash that will come in from collections to meet his probable cash requirements.

The Treasurer's Obligation to Control Working Capital

This need for advance information concerning his developing cash situation originates with the initial organization (or, sometimes, the reorganization) of the enterprise. The need is born of the natural limitation upon the proportion of net working capital which those who organize the business contribute for its conduct.

It is recognized as an ideal that those in charge of the finances of a business should supply only that amount of working capital which can "work" continuously and thereby assure its owners the maximum return. They should not furnish more than that amount because any idleness of the excess, even though temporary, will reduce the average rate of return upon their total working capital.

Accordingly, the limited working capital supplied by those in charge of the finance must be supplemented during times of business activity, through contributions by outsiders who desire temporary investments only and who accept the current notes of the enterprise.

However, against this natural pressure to increase current borrowing up to the limit of a convenient cash position during a period of activity, there is still the penalty of reduced earnings if working capital, owned or borrowed, is not at all times limited to the actual requirements of "work" to be done. Thus, the presence of abundant working capital is an out-of-the-ordinary condition, for the "natural" development of a business obligates the treasurer to constant observation of his cash situation and the profitable manipulation of his working fund.

Such an economic control of the working fund is predicated upon an initial control of the business itself. The conduct of a manufacturing business necessitates the expenditure of capital for certain assets and the manufacture of merchandise before the sale of that merchandise. Normally, the sale of this merchandise should yield enough to cover its cost, and more. Theoretically, the more the concern spends, the more it will get—plus more profits. But in practice, limits are found:

1. In the capacity of the consumer.
2. In the ability of the manager to gage that capacity.
3. In the availability of resources to permit purchase of the right goods in advance.

The earlier articles of this series have described how we respond to these requirements. Research reveals facts, and analysis the implications of these facts, to aid in deciding what to lay in store, in deciding what additional expense to authorize, and in the other decisions pertaining to the expenditure of capital in advance of sale. The third requirement suggests that, in the last analysis, current expenditure is largely predicated upon current receipts, for growth must be gradual and healthy and increasing stocks through reinvestment of earlier profits must somewhat precede increasing current borrowings.

The Treasurer's Control of Cash

Granted an effective general control of the main factors affecting working capital, the month by month control is exercised by the treasurer through control of cash. Control of cash implies the control of the two factors—disbursements of cash, and receipts of cash.

Disbursements are possible of relatively complete control. In a general sense, if forward commitments have been controlled, disbursements by cash discount or at due date, will care for themselves. More specifically, budgetary control, as a tool in the hands of the management, will prescribe the limitations of forward commitments and of current expense. Under such control, commitments and expense obligations will have been authorized and fully determined before they require cash disbursement. Consequently, the proportions of commitments and obligations maturing, and therefore requiring disbursements in cash, during the coming month should be reasonably well estimated from the records in hand.

Receipts of cash, on the other hand, are not so definitely within control. To be sure the granting of credit may be well guarded, but the quantity of cash to be received during the coming month may not be so readily estimated.

Nevertheless, the treasurer must have available well in advance an accurate estimate of receipts, so that he may be assured that cash balances will always care for current payments. A temporary excess of disbursements, lacking an already adequate cash balance, will necessitate current borrowings, leisurely planned in advance. On the other hand, a temporary excess of receipts will indicate the wisdom of liquidating outstanding notes, if the excess receipts are not shortly to be offset by a recurring excess of disbursements.

Thus, emphasized, do we see the treasurer's constant need for current statements of the accurately anticipated inflow of cash and his direct dependence upon the controls established through the other activities of budgetary procedure.

Place of Receipts' Estimate in General Plan of Control

The estimate procedure to be outlined here presumes that the treasurer is statistically posted as to his current and developing cash situation. Daily reports of balances from all disbursing or receiving units; immediate end-of-month reports from each sales unit covering balances of open accounts, of trade acceptances, of notes and of drafts receivable; special reports as to condition of particular classes of accounts; and many like statistical records are the everyday tools of any credit department.

It is further presumed that if the sales units responsible for receipts are scattered geographically, there will be established a routine for recording in advance of the month each unit's own estimate of probable receipts. In our case such an estimate is included with the data submitted for the monthly master budget estimate described in Article Four.[1]

Thus the procedure to be described is a central office analysis to consider the significance of present data and to confirm or revise the original estimator's judgment as to next month's probabilities.

Collection Conditions

The estimating method to be outlined here is founded on a "Collectibles Fund" which we evolved and defined after a consideration of our terms of payment.

Our usual terms of payment allow 60 days net. There are practically no strictly cash sales. Usual cash discount terms are 10 days from invoice date. Continuous jobbing customers are allowed to discount the month's invoices on the tenth of the following month. Except with a few of our units, the proportion of customers accepting cash discounts is not large. Trade acceptances at 90 days are not yet popularly used. Notes are accepted by us, at times, but sparingly. On the other hand, our foreign business commonly utilizes drafts of six months' to a year's maturity, some of which we immediately discount, and some of which we hold until maturity.

So varying are these possible terms of payment in our line of business and so varying is the month by month rate of sales that the collections of any particular month cannot be definitely related, by ratio, to the sales of that same month nor, by "lag," to the sales of any previous month. Even notes and drafts are so voluminous that it is impracticable to keep separate record of their maturity dates for estimating purposes.

Nevertheless we reasoned that an estimating method might be developed by "relating things to their causes." It is obvious that our sales do not directly materialize in collections. From the opposite viewpoint, however, collections in any month must necessarily have been a receivable of some kind in that month. It may have been a receivable at the first of the month, carried over from the previous month, or it may have been a receivable resulting from one of the month's sales. We reason, however, that any invoice, dated later than the fifteenth of that month, is unlikely to become a cash receipt within the month; even if discounted, the receipt of cash would fall in the succeeding month.

The "Collectibles Fund"

It follows that the collectibles—these accounts which may be the cause of cash receipts during the month—comprise the receivables of the first of the month plus the first 15 days' sales of the month. To this "Collectibles Fund" it would seem, the collections should maintain a definite relation.

The constancy of the ratio of collections to this "Collectibles Fund" for a typical sales unit, is graphically shown in Fig. 11. From month to month during any year the ratio is constant, reflecting a consistent seasonal variation at certain times of the year, and a gradual improvement in collection conditions during the full "recovery" period of this business cycle.

The revealed constancy of this collections ratio suggested estimating possibilities. Nevertheless, to be of value to the treasurer, the cash receipts estimate for the month must be available well in advance of the month, in fact, about the twentieth of the previous month, when the master budget estimate is compiled. Of course, at that date the actual collectibles fund for the coming month is not developed.

To become effective, then, the estimating of collections by this method necessitates, first, a prediction of the collectibles fund for the coming month. Table 12 shows the complete work sheet for estimating July collections by predicting collectibles.

The sheet provides a line for each division selling to jobbers, for each branch selling to the trade, and for

[1] See MANAGEMENT AND ADMINISTRATION, October 1923, p. 453.

each subsidiary merchandising corporation, the calculation in each case proceeding horizontally across the sheet.

Column 1 records the known receivables of all kinds as of June 1, the latest first of the month for which actual figures are available. The amounts inserted include all "rights to collect cash," arising from the sale of goods, whether the present form is as an open account, trade acceptance, note, or draft. The amounts recorded represent the actual "rights" before deducting reserves.

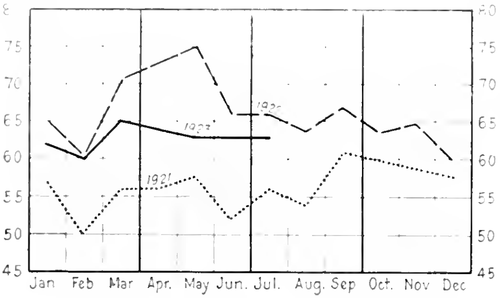


FIG. 11 TYPICAL UNIT'S RATIO OF COLLECTIONS TO COLLECTIBLES

Column 2 records the actual sales total for the first 15 days of June - the current month. The calculation is made on June 20, and June 15 is the latest day for which we can get month-to-date actual sales totals on a comparable basis for all sales units. The purpose is to predict the month's probable total sales, and it is desirable, of course, to predict the full month's sales from as large a "sample" of that month as possible.

Column 3 records the rato that the first 15 days' sales of June will probably bear to total June sales. If account be taken of its seasonal variations, this 15-day ratio is fairly constant from month to month. The actual ratio may vary as between these sales units for various reasons but the ratio for any one unit is reasonably constant.

Column 4 records the predicted total sales for June upon the basis of its first 15 days' sales, the month's total being found by dividing the 15-day total (column 2) by the percentage (column 3) expressed as a decimal. The month's total sales, thus predicted upon the basis of recent actual figures, may be verified against the estimate embodied in the authorized June budget. In addition, it may be verified against the predicted June total, derived by assuming that the June total will run over or under the May month's total by the same *percentage* that the June 15 to-date sales exceeded the May 15 to-date sales. On the whole, the 15-day ratio is the more reliable method, if the seasonable ratio has been selected, but the checks are valuable for insuring avoidance of gross error in predicting.

Columns 5, 6, and 7 record the calculation involved in predicting the month's total collections, the method exactly paralleling that employed in columns 2, 3, and 4 for predicting the total sales for the month. Similar checks may be established for providing against possible gross errors.

Predicting the Collectibles Fund—Items of Current Month

Column 8 records the predicted receivables as of the first of July, the month to be estimated. The assumption is that June 1 receivables balance will be affected only by new June sales set up as some kind of a receivable, or by the collection of a receivable. Therein develops slight error, for the "collections" covered by columns 5 to 7 refer to cash receipts, not to all credits to receivables. If a customer avails himself of his cash discount privilege, the "cash receipt" will underrun the actual "credit to receivables" by a small percentage. The proportion of our customers discounting, however, is not large enough to introduce appreciable

TABLE 12 WORK SHEET FOR ESTIMATED COLLECTIONS

As of June 2[illegible], [illegible] Month of July

	Preliminary Receivables as of June 1	June Sales: Actual 15 Days	June Sales: 15-Day Ratio	June Sales: Predicted Total	June Collections: Actual 15 Days	June Collections: 15-Day Ratio	June Collections: Predicted Total	Predicted Receivables as of July 1	July Estimated Sales: Est. Total	July Estimated Sales: 15-Day Ratio	July Estimated Sales: Est. for 15 Days	Est. Rec. Bal. as of 7-1 Plus Est. Sales 15 Days	Collection Ratio: For Apr.	Collection Ratio: For May	Collection Ratio: Year Ago July	Collection Ratio: Used for Est.	Est. Amount of Collections During July
	1	2	3	4 2 ÷ 3x100	5	6	7 5 ÷ 6x100	8 1 + 4 − 7	9	10	11 9 × 10	12 8 + 11	13	14	15	16	17 12 × 16
X Division	000,000	00,000	45.6	000,000	00,000	52.2	000,000	000,000	000,000	45.6	00,000	000,000	55	50	54	52	000,000
Y Division	000,000	000,000	43.3	000,000	000,000	52.1	000,000	000,000	000,000	43.3	000,000	000,000	64	63	66	62	000,000
. . .																	
Total Divisions	000,000	000,000		000,000	000,000		000,000	000,000	000,000		000,000	0,000,000					000,000
A Branch	000,000	00,000	38.8	000,000	00,000	53.2	000,000	000,000	000,000	38.8	00,000	000,000	49	49	45	51	000,000
B Branch	000,000	00,000	39.2	000,000	00,000	51.5	000,000	000,000	000,000	39.2	00,000	000,000	43	42	45	42	000,000
C Branch	000,000	00,000	32.2	000,000	00,000	59.7	000,000	000,000	000,000	32.2	00,000	000,000	59	58	55	58	000,000
D Branch	000,000	00,000	46.7	000,000	00,000	73.2	000,000	000,000	000,000	46.7	00,000	000,000	41	41	46	43	000,000
E Branch	000,000	00,000	26.0	000,000	00,000	58.7	000,000	000,000	000,000	26.0	00,000	000,000	39	39	41	39	000,000
F Branch	000,000	00,000	37.8	000,000	00,000	70.1	000,000	000,000	000,000	37.8	00,000	000,000	57	64	49	65	000,000
. . .																	
Total Branches	0,000,000	000,000		0,000,000	000,000		0,000,000	0,000,000	000,000		000,000	0,000,000					0,000,000
A Subsidiary	000,000	00,000	34.8	000,000	00,000	42.2	000,000	000,000	000,000	34.8	00,000	000,000	43	45	30	43	000,000
B Subsidiary	000,000	00,000	37.0	000,000	00,000	70.0	000,000	000,000	000,000	37.0	00,000	000,000	67	64	59	65	000,000
C Subsidiary	000,000	00,000	34.0	000,000	00,000	42.0	000,000	000,000	000,000	34.0	00,000	000,000	45	45	39	43	000,000
Grand Total	0,000,000	000,000		0,000,000	000,000		0,000,000	0,000,000	0,000,000		000,000	0,000,000	52	52	51	53	0,000,000

error, and, even if it did, the error would be constant and could be allowed for. Journal entries, crediting off bad, or uncollectible accounts, since they do not reduce receivables by an actual cash receipt, would also introduce error into the prediction. However, all the possible errors thus introduced are not significant in the light of the wider margin of error, known to be unavoidable in any kind of economic prediction.

Column 9 records the total July sales, already estimated as part of the monthly budget routine, and as outlined in Part 1 of Article Four.[2]

Column 10 records the 15-day sales ratio anticipated for July. Since July is in the same season of the year, the ratio would vary but slightly, if at all, from the June 15-day ratio of column 3. Of course, the reason a 15-day ratio is used is in order to derive the probable sales of the first 15 days of July. And the reason we take the first 15 days of July sales, rather than 20 or 25 days, was previously stated in our definition of the "Collectibles Fund."

Column 11 records the estimated sales for the first 15 days of July, the estimate being derived by multiplying the estimated month's total sales (column 9) by the column 10 percentage expressed as a decimal.

Column 12, then, records for each unit the "Collectibles Fund" as of the first of the estimated month July. This fund comprises the column 8 predicted receivables as of July 1, plus the column 11 15-day sales. This is the fund which had to be estimated first, in order to reach the goal originally sought—an estimate of July collections.

Estimate of Collections Based on Collectibles Fund

It follows, now, that the column 17 estimated July collections may be derived by applying the selected collections ratio to this collectibles fund amount of column 12. To aid in the selection of the ratio to be inserted in column 16, some of each unit's relevant past ratios (the latest two "actuals" available and the "year ago" ratio) are inserted in columns 13, 14, and 15. It is not presumed that these few representative ratios are sufficient to enable final selection of the proper ratio for the estimated month. To aid in the selection, reference would better be made to a ratio trend chart similiar to Fig. 11. From such a chart may be observed the unit's usual seasonal variation in the ratio, and it may be assumed that this seasonal variation will be reflected in this year's ratio trend, even though the ratio trend for this year may be gradually relinquishing its recent levels which have been sustained, say, 10 points higher than the "year ago" ratio trend level.

The estimated amounts first inserted in column 17 must be verified for "reasonableness," for no formula is infallible in its operation. For instance, the collections in July are unlikely to be either greater than the highest monthly sales attained (or estimated) for April, May, or June, nor less than the lowest monthly sales total for those immediately preceding months. Further, the collections amount should closely agree with the unit manager's judgment, as expressed in his estimate of July collections. Indeed, if the variation proves slight, there is no occasion for revision of his estimate, which then stands approved.

These and other tests of "reasonableness" and allowances for anticipated exceptions to the rule, require constant care in determining the final figure to be inserted in column 17, but that final figure, when inserted, recognizes the "relation of things to their

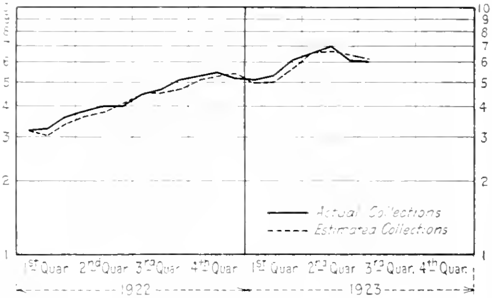


FIG. 12 COLLECTIONS PERFORMANCE AGAINST ESTIMATE

causes," represents a consideration of all the facts, and stands as the final judgment as to collection probabilities.

Checking Performance Against Estimates

Now any treasurer, faced with the problem of day-to-day control of cash, will naturally ask the pertinent question: "Does all this theory work in practice?"

For us, it does. Fig. 12, drawn to ratio scale, shows our collection performance to date since employing the present method of estimating collections. This performance comparison of the grand total shows first the tendency to estimate conservatively. But analyzing further and allowing for this confirmed conservative tendency, the chart reveals the degree of success we have had in anticipating the direction of change in the collections level, and in gaging the degree of that change.

Although we recognize that any formula or method applied in business is fallible to some degree, the present method has resulted in a distinctly valuable accuracy. Approximate accuracy is obviously necessary if the estimate of cash receipts is to be of value in guiding executive policy.

Nevertheless, we do not presume that we have yet reached the ultimate accuracy with which we shall be able to aid the treasurer. There is always a continuing checking-up of performance against estimate. For this purpose, a monthly collections report is issued immediately after the close of the performance month. Constructive analysis of this performance report stimulates investigation as to the reasons for deviations from estimate. And, finally, as a consequence of such investigation, an increasing acquaintance with the reasons for exceptions to the rule will inevitably lead to more intelligent and effective utilization of an estimating method essentially sound in principle.

(To be concluded in the December issue.)

[2] See MANAGEMENT AND ADMINISTRATION, September 1923, p. 313.

Planned Repetitive Manufacture of Heavy Equipment—Steel Coal Cars

"Practical Methods of Planning Work"—Article Five

By WILLIAM B. FERGUSON

Consulting Engineer

Class Number
658.51 Planning
658.9:625.246 Steel car building.
Management

PREVIOUS articles[1] have dealt with the fundamental principles of planning as applied to large projects of a non-repeat nature, where the operations were so numerous and varied as to make standardization impracticable. We now take up the case of manufacturing to order or on contract a small number of articles of the same design, compared to the usual repetition manufacturing or production in large quantities. The example selected is that of an order of 1500 steel coal cars, hopper type of 57½ tons capacity, manufactured for the Chesapeake and Ohio Railroad by the Car Plant of the Newport News Shipbuilding and Dry Dock Company.

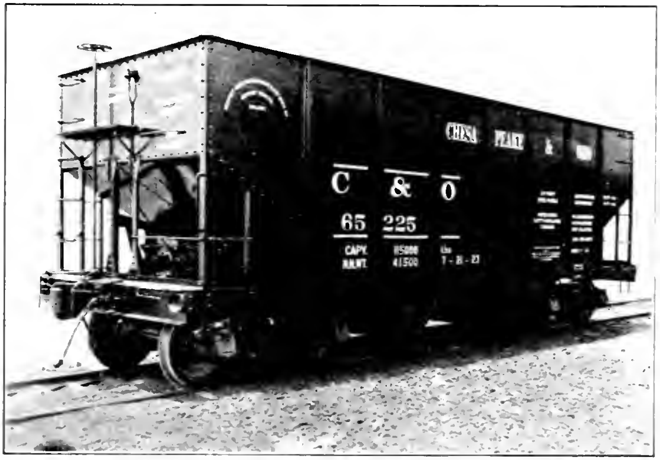


FIG. 43 STEEL COAL CAR, HOPPER TYPE, MANUFACTURED BY THE CAR PLANT OF THE NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

There are several interesting production problems in this class of work which do not occur either in repetition work in very large quantities, as automobile manufacturing, or in construction or repair work previously described. The same principles of correct planning will be observed, however, to run through every form of production; and the same attention has to be given to thoroughness of details of plant layout, routing, task-setting, material control, and inspection, in all forms of production.

Some of these problems present themselves at once when you consider that in the small car plant you have only a few machine tools compared to the large number of distinct and separate operations to be performed on the 300-odd parts or pieces of different design that have to be fabricated for the freight car. The generic processes are very few—as punching, shearing, press-work, joggling, drilling, etc.—but with special dies and jigs for the various parts a new "set-up" is required on machines for each lot of parts. One problem then arises, as to the size of each lot of parts, to run through each machine and operation, in order to accomplish two conflicting purposes:

1. Make the lot large enough to keep the fabricating cost down, and save time of new "set - ups" shifting to new parts, and other losses incident to small lots.
2. At the same time do not unduly delay starting the subsequent work of subassembling the fabricated parts, and the work of erection or final track assemblies, as the time of starting deliveries is very important to the customer.

These conflicting purposes require a compromise solution, figuring out from a study and analysis of machine capacities the minimum lots to put through for each part, to keep a continuous flow of materials, by lots, through each operation. This study in turn requires, for the best results, a chart or table showing the standard or estimated hours for each lot of pieces to pass through each operation. Except for the process of shearing, which is very rapid, it is best to have each lot large enough to make half-a-day's work for each operation, so as to insure continuity of material flow and continuous piecework. That is, the "bank" be-

[1] See *Management Engineering*, May 1923, p. 293; and June 1923, p. 369; also MANAGEMENT AND ADMINISTRATION, July 1923, p. 33; August 1923, p. 185.

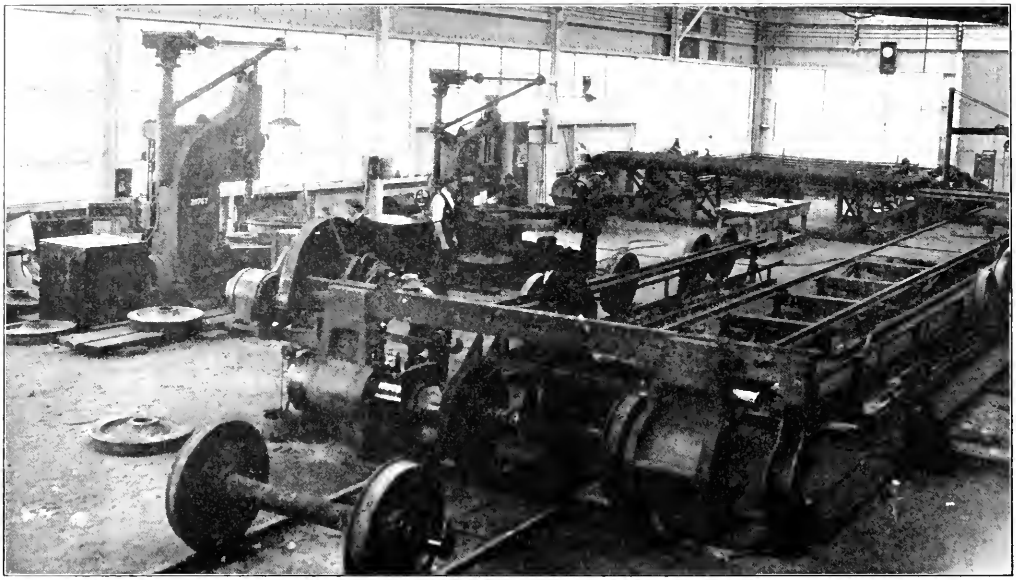


FIG. 44 INTERIOR VIEW OF WHEEL AND AXLE SHOP WHERE WHEELS ARE PRESSED ON THE AXLES

tween operations, as in all manufacturing, should be carefully provided for, and should be insured by careful planning and dispatching.

The difference between jobbing and economical manufacturing, and the main reason for the same operations being so much more economical in the latter than in the former, is this: You can work to a "bank" in manufacturing, and plan to forestall and prevent men and machines waiting for materials. If you plan and keep a bank of four hours' work ahead of each operator, then a breakdown or other delay at any preceding operation which can be remedied within four hours does not break the material "flow" or continuity. This is of the greatest importance in practice, but is frequently not observed, and unless really controlled by planning, the foreman is apt to keep the work spread too thin in the shop. The contrary evil of having too large a bank, or too much work in process can also be controlled by proper planning, but in no other way.

The manufacturing job under consideration was for 1500 freight cars, having a total weight of materials of 41,500 lb. per car. The average car manufacturer usually fabricates only the body or structural steel proper and a portion of the truck materials; the wheels, axles, journal boxes, bolsters, draft rigging, couplers and other truck materials are generally purchased from specialty manufacturers. The car builder assembles all the materials, usually on the progressive track sytem, as in automobile manufacturing. The erection system which will be briefly described is on a track having 22 stations—the first one being the Truck Assembly Station. The same gang always does the same work on each car, each gang remaining at its own station.

Fig. 43 shows the type of car manufactured. Figs. 44, 45, and 46 show views of the Wheel and Axle Shop and the Press Shop.

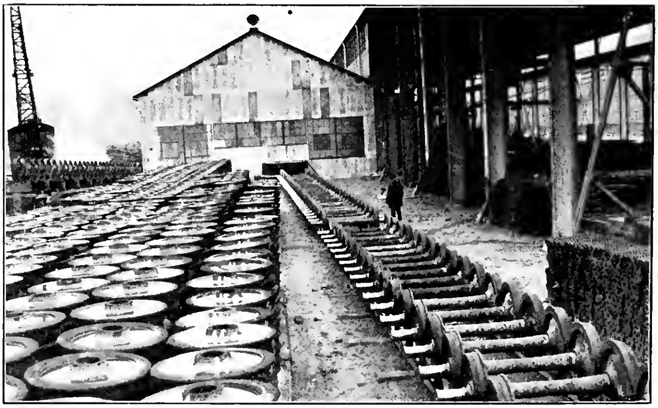


FIG. 45 CAR WHEEL AND COMPLETED WHEEL AND AXLE STORAGE

The locomotive crane at the left loads the wheels on the runway leading into the wheel and axle shop. The assembled wheels and axles are rolled out of the shop toward the observer.

For convenience in marking the shop drawings, in ordering material, in planning production and in keeping costs, one of the first things to be done in manufacturing of any kind is to devise a symbol or marking system which arranges the parts in their proper erection sequence. It is well to think out the whole system in detail, and to plan out the routing, subassemblies, and erection stations before the symbols for parts and operations are definitely assigned. A job analysis is

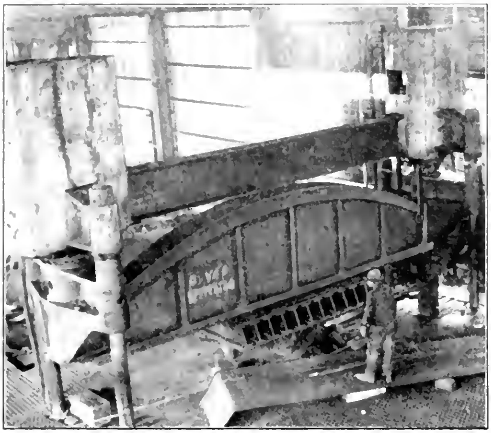


FIG. 46 FLANGING PRESS IN THE PRESS SHOP

made for each part to be fabricated, detailing the operations in sequence, also for each subassembly with its separate operations, and the same thing for the work to be performed at each erection station on the track. The symbol system used in various factories will be recog-

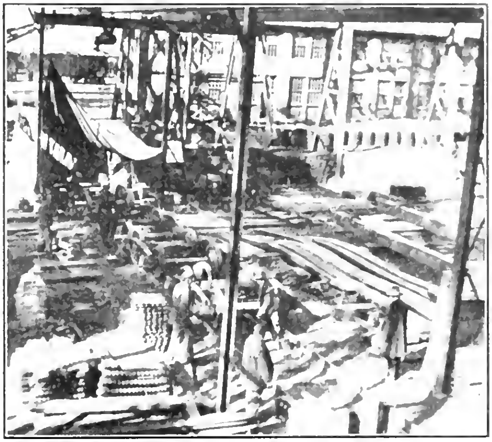


FIG. 47 ERECTION TRACK AT STATION NO. 1
Preparing for truck assembly.

nized at once, where a letter is inserted between the model number and the part number, with the operation number following the part number, thus:

2M101 1 means
2M = No. 2 Model
Part No. 101 = Wheel
Operation No. 1 = Bore

The 324 separate parts in the car are numbered 101 to 845, with the series 101 to 199 covering parts for trucks, series 201 to 249 covering the underbody, and so on, to correspond as closely as practicable to the parts assembled or erected at the various track stations.

FIG. 48 ERECTING STATION NO. 5 WHERE THE DRAFT GEAR IS INSTALLED

The subassemblies are given their own distinguishing marks or names, to facilitate planning and the collecting of records of production and costs, thus:

- 041 = Subassembly of inside hopper sheets, which is the first subassembly of the parts numbered 400, etc. (Parts No. 416, 417, 418, 419.)
- 055 = Subassembly of subside sill right—parts numbered 500 etc. (Fifth subassembly in this series.) There are 16 pieces in this subassembly.

As in other manufacturing, it is useful to make up a dependent sequence chart of the numbers showing (1) Parts, (2) Subassemblies, (3) Final Assemblies; and to schedule the cumulative production required, at the top of such a chart, in order to keep the proper and steady flow of parts and subassemblies at all times. The determination of the track-work to be done at the various stations and the balancing up of the work at each station for a certain force of men at each, becomes a practical problem of considerable difficulty, determined partly by observations and time studies, but mainly by actual trial after piece-rates are set and the real output per gang under an incentive system is determined. Slight adjustments of the original plan—what exact parts to be applied at this station, what exact rivets to be driven at that station—are to be expected, until the erection work is well under way.

The Progressive System described for building flat bottom gondola cars by the Pressed Steel Car Company in their description of one of their plants is not unlike that mentioned for the 57½ ton steel hopper bottom cars in this article for Newport News.

Table 4 shows in condensed form the principal work done at the various track stations in the two car plants.

The work is so apportioned to the various stations that it can be completed at each station and the line of cars moved every 25 mins. The photographs, Figs. 47 to 53, show the cars at various degrees of completion at the several stations. Fig. 47 shows the first wheels and axles rolled on to the erection track at station No. 1, preparatory for the truck assembly. Fig. 48 shows the draft gear being installed at station No. 5. Fig. 49 shows the riveting of hopper sheets and floor sheets at station No. 7. The total number of rivets driven here is 244. Fig. 50 shows reaming and riveting of floors to sides and ends at station No. 12. The total number of rivets driven here is 192. Fig. 51 shows the riveting of sides to outside hopper sheets and cross hood at station No. 13. The total number of rivets driven here is 226.

Fig. 52 shows two lines of cars on the tracks—those at the right under the low trestle work are coming toward you, the last station being No. 10, where small parts are bolted up; those at the left are moving from you, stations No. 11 to 20. After the brake rigging is installed at station No. 20, the cars are painted by spraying. In Fig. 53, a line of completed cars is ready for shipment.

The mechanical devices and special equipment designed for fabricating and subassembling car parts are of greatest importance in economical and speedy production, and in this respect resemble any repetition manufacturing processes. The design and use of fixtures and jigs, and the design and making of dies for all the pressed work, is a problem of first magnitude and of a special nature, peculiar to this class of work. This article being limited in its scope to planning methods only, does not undertake to go into such important mechanical engineering features, which are peculiar to the design of any manufactured article, although such features may be and usually are of prime importance in production. They have to be worked

TABLE 4. SHOWS WORK DONE BY PRESSED STEEL CAR CO. IN BUILDING FLAT BOTTOM GONDOLA CARS, AND WORK DONE BY NEWPORT NEWS SHIPBUILDING AND DRY DOCK CO. IN BUILDING 57½ TON STEEL HOPPER BOTTOM CARS

Station No.	Newport News Shipbuilding and Dry Dock Co.	Pressed Steel Car Co.	Station
001	Truck Assembly	Truck Assembly	1
002	Underbody: Bolting up body center plates, subassembly 025 (center sill construction), subassembly 023 (body bolster construction), floating lever guides, end sills, etc.	Underbody: Apply center plates, center sills, diaphragm, bolster and end sill connections, floating lever fulcrum construction, draft sill ties, etc.	2
003	Reaming station	Apply bolster to bolster jig and square up diaphragms. Rivet up all above work. Apply end sill constructions. Apply and rivet end door links. Rivet end sill cover plates, etc.	3
004	Rivet body center plates, body bolster tie plates and connecting angles, floating lever guides, cross hood subassembly, etc.	This position on track is left open to prevent crowding.	4
005	Apply draft rigging and subassembly 041 (inside hopper sheets).	Apply and ream: Center sill cover plate and body bolster top plates.	5
006	Floor construction. Apply cross hood brace subassembly and floor sheets subassembly.	Portable rivet: Center sill cover plate, body bolster top plates, and cross bearer top plates.	6
007	Rivet—hopper sheets to floors and cross hood sheets. Apply body cross ties.	Turn sill. Ream. Riveting cross bearer bottom plates to center sill stiffeners. Apply and rivet cylinder supports, etc. Apply draft rigging.	7
008	Side and ends. Apply. Also corner post caps.	Portable rivet: Bolster bottom tie plates, center plates, side bearings, etc. Turn sill back.	8
009	Bolting sides and ends.	Apply and ream side construction, corner caps, side and end sill gussets, etc.	9 & 10
0010	Bolting small parts such as end post subassembly, ladder angles, hand holds, hand brake, fittings.	Rivet diaphragms to sides, bolster and side connections to sides, etc. Apply and rivet push pockets, diagonal braces, etc. Apply end door construction.	10 & 11
0011	Reaming sides, ends, and small parts.		
0012	Riveting sides to floor and corner post, floors to corner posts, end post, etc.	Apply and rivet side steps, pipe clamp supports, etc.	12
0013	Riveting sides of car to floors, cross hoods and hopper sheets.		
0014	Riveting subside sills, corner posts, hand holds, diagonal braces, etc.		
0015	Drop door mechanism. Apply complete.		
0016	Purchaser's inspection.	Purchaser's inspection.	13
0017	Rectifying any work developing by inspection; miscellaneous riveting.		
0018	Cleaning cars.	Cleaning cars.	14
0019	Piping and air-brake fittings.		
0020	Brake rigging.	Brake rigging.	15
0021	Painting and stenciling.	Painting and stenciling.	16
0022	Final inspection.	Final inspection.	17

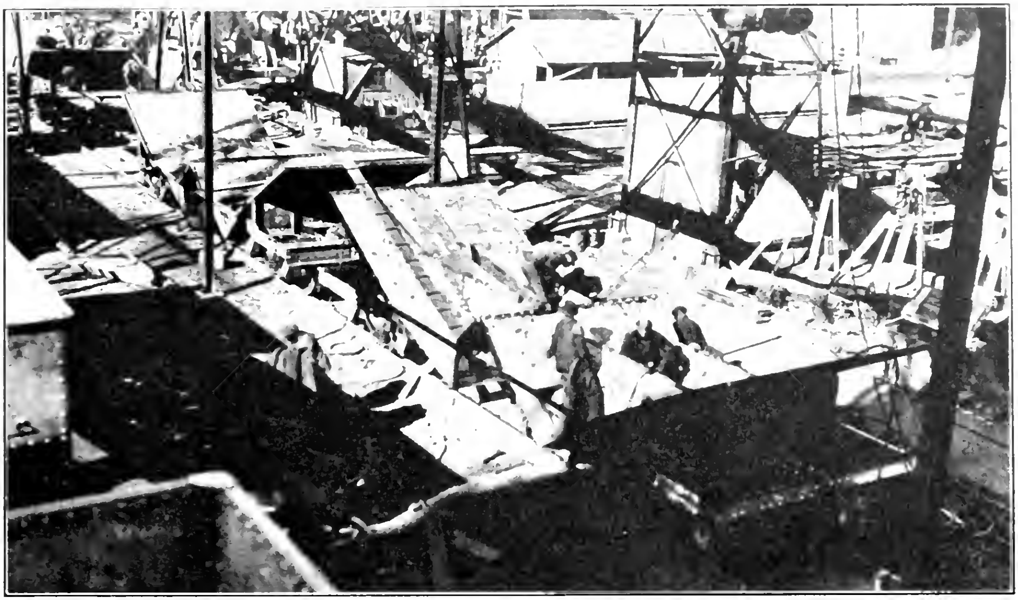


FIG. 49 ERECTING STATION NO. 7 WHERE THE HOPPER SHEETS AND FLOOR SHEETS ARE RIVETED

out, developed, tried out, and time studied, as a part of the practical planning and execution of each order for cars that is received.

It is impossible in practice to separate or consider independently the mechanical processes, the machines and equipment, and the layout of the shops, as distinguished from such production planning as we have in mind when we confine ourselves to such mechanisms of management as job-analysis, time studies, setting standard times, incentive systems, cost keeping and cost control, material routing and dispatching, and finally the control of quality by adequate inspection. It is absolutely necessary to have proper equipment and tools and material before we can produce at all, with any speed and accuracy.

Possibly this tacit acknowledgment of these necessities for production has something to do with the frequent and perhaps customary neglect of the other "mechanisms of management," which start with the equipment necessities; and with this equipment, and no more, and with the same personnel, and no more, these mechanisms enable the management to increase the production and decrease the total costs far beyond the experience or beliefs of the average process foreman. The management's tools and mechanisms are just as useful and quite as necessary to the modern manager for economical production as the machines and dies and jigs are useful to the processing foreman. The steps taken by the manager to increase production and decrease costs, after his equipment and tools are all in shape to process the

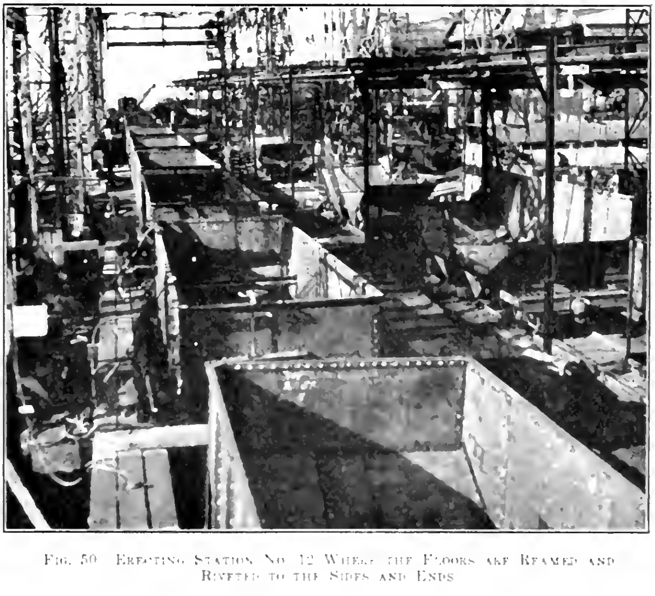


FIG. 50 ERECTING STATION NO. 12 WHERE THE FLOORS ARE REAMED AND RIVETED TO THE SIDES AND ENDS

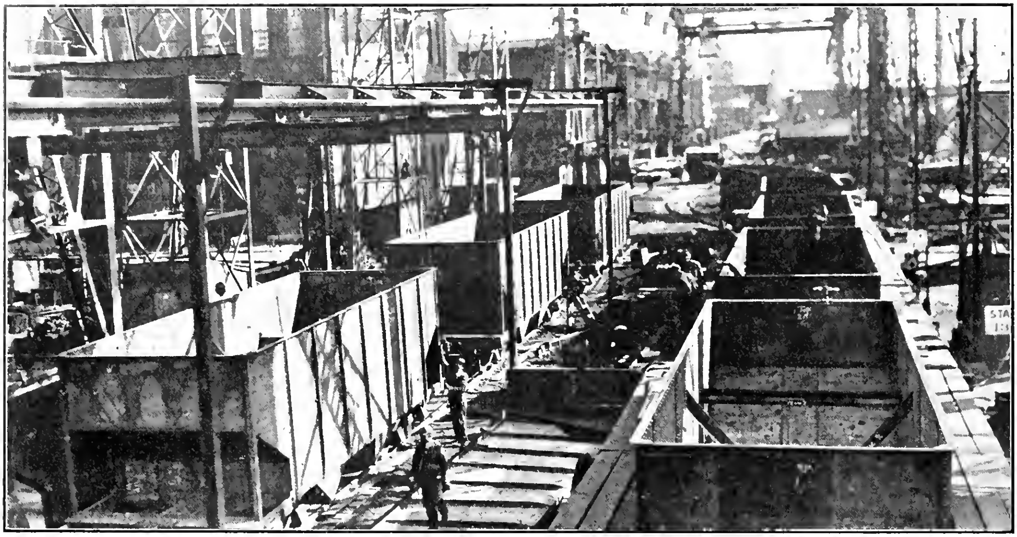


FIG. 51 ERECTING STATION NO. 13 WHERE THE SIDES ARE RIVETED TO THE OUTSIDE HOPPER SHEETS AND CROSS HOOD

materials and to assemble the processed parts, are of more than passing interest.

The closest analysis of operation costs and of incidental or indirect costs is a matter of the greatest moment, when we go about the business of getting the most out of our equipment. This analysis cannot be made unless the actual records of production or output—by departments, machines, men, processes, operations—are purposely and deliberately collected in convenient, complete, and adequate form. The design of the production and cost system is therefore a job for a purposeful and deliberate body that is determined to get the facts and figures as they are; and to compare these facts and figures with the predetermined standards of what they ought to be.

This brings us to a consideration of standards: How to determine what should be a fair time allowance for a definite task? How much should you pay a mechanic who produces twice as much as another, both rated at 70 cents an hour, and using the same tools, same operation, etc.? Should you not pay each man, and every man, what he is worth to the company, if you can determine what he is worth? Is it not the management's duty, as a matter of fairness and justice, to determine in a thorough manner, how long it should take a good mechanic to perform each operation that can be fairly tried out, and then to base the pay of each man on his earnings, rather than on his hours? We have all found by experience that no man ever produces his best or his easiest unless he has some incentive, and that the financial incentive when fairly distributed (and where rates once set are not cut) is the one which profits both men and management. The best form of incentive system is perhaps debatable, from both the psychological and the bookkeeping standpoints, but any kind of a good incentive system is better than a day-work system for either production, profits, or personnel. A good incentive system makes more work for the management, of course—more study, more analysis, more thoroughness, more patience, more justice, more education—that is to say, it makes for better management. A good incentive system means lower production costs and thence more orders, more production, more profits, more jobs for more good men, more ambitious and more contented workmen.

If we are willing to try a good incentive system, every man paid according to his output (volume and quality), and are desirous of distinguishing between false standards of performance which are mere "guesses" and real standards set by trusty and experienced men who are interested in increasing production and profits, then we are in a frame of mind to study the perquisites and requisites of a good incentive system.

Planning, practical planning, in its broadest interpretation—foresight, looking ahead, mapping out in thorough detail the step-by-step methods of records, analysis and control of material, production and costs—this is one of the requisites of a good incentive system. By that I mean that the plans and follow-up of the plans must prevent the happening of the usual causes of such delays and idleness of machines or men as stop their continuity of effort and performance.

Let us apply these thoughts to the making of freight cars, or, for that matter, to any production in quantities.

The bare outline of the steps is somewhat as follows:

1. Analyze in detail the product as to the operations to be performed on each part or piece; visualize (preferably in graphic form) the relations and

interdependence of each operation and part; plan the mechanical equipment and processing in detail.

2. Then by study, observation, and trial determine the capacities of machines and equipment under proper operating conditions; tabulate and compare the results.
3. Determine by concentrated analysis the proper size (number of pieces) of each lot, separately for each part or piece, in order to provide and insure a steady stream or continuous flow of parts—every step from the raw material to the final assembly.
4. Plan the flow of parts, and have some person or persons control the physical movement of parts, through all the operations, according to the plan.

After these steps are taken, but not before, we are in a position to talk about putting in a "good" incentive system.

Let me illustrate in car-building, with the fabricating of one part or piece, taking as an example: End sheet, A end—part No. 551. This part required three simple operations, before a jig eliminated the first—laying off, punching, shearing. The standard output or estimated day's work per machine (or gang) was:

Laying off— 50 pieces per 8 hr.
Punching — 67 pieces per 8 hr.
Shearing —200 pieces per 8 hr.

Now supposing we had to run through small lots of 200 pieces, on account of having to alternate this part with other parts on the machines, in order not to hold back early deliveries of cars. Then we see that 200 pieces makes:

4 days' work in laying off
3 days' work in punching
1 day's work in shearing

In order to provide a continuous flow of these parts, through punching and shearing, it is evident that we should not start shearing (1 day's work) until the lot of 200 pieces is all punched (150 is the absolute minimum, but 200 is better for safety). Likewise we should not start punching until at least 100 parts are laid off. The safe way to do is not to move the parts from the operation just finished until the whole lot of 200 is completed. The unsafe and wrong way is to leave it to the foreman who will probably move material, when there is a good-sized pile, on to the next operation, so that the following comparative results are obtained in production:

	Day	1	2	3	4	5	6
First way—the right way	L	50	50	50	50		
	P			67	67	66	
	S			—	—	—	200
Second way—the foreman's way	L	50	50	50	50	—	
	P	40	50	45	40	25	
	S	20	60	40	40	20	20

It is simple enough to keep daily records showing such results as these, and yet the mere keeping of records does not suffice; action has to be taken, basing your judgment upon what the records reveal. In the above case, you predetermined that the right way was to let a gang lay off 100 pieces on the first and second day, but not to let a gang start punching until the third day; and not to let a gang start shearing until the sixth day. Do not keep this right way a profound secret; but act on the knowledge. The foreman is not trained to this sort of analysis, and besides he has a hundred other things to do, so that the crane men move material as it piles up, and the punch gang punches the first 40 plates it gets the first day, 50 the second, 45 the third, 40 the fourth, and 25 the fifth. Meanwhile they may have punched other odd lots, but the net result is they are operating below their normal capacity, and do not make out in piece-rates

FIG. 52 TWO LINES OF CARS ON THE ERECTING TRACKS

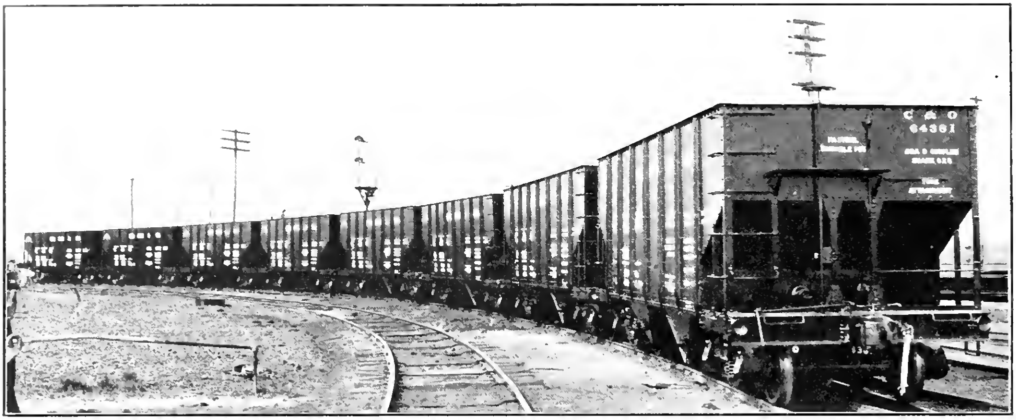


FIG. 53 COMPLETED CARS READY FOR SHIPMENT

and say the prices are too low. Then the trouble begins. The shearing gang plays along and takes 6 bites at the lot, instead of one, and they naturally act the same way as the punch gang.

Now the solution is very simple in most cases of this kind: Do not break the lot, but move only a *full* lot. Get away from jobbing methods and go into economical manufacturing. But do not start men piece-work or task-bonus or any other incentive plan until you have a good day-work system going and your material is properly routed and moved.

(To be concluded in the December issue.)

Patent Frauds and Remedies

By THOMAS A. HILL

Member of the Bar, United States Supreme Court

Class Number 608 Patents

MANUFACTURERS, patentees, and the general public have been duped so often with patents that many now avoid anything in the nature of a patent investment, while others dread the unexpected appearance of a patent covering some commodity of their business which will subject them to protracted and expensive litigation, and when it is considered that several thousands of patents are applied for weekly, at least half of which are subsequently granted, mostly for inventions of very limited merit, it is not surprising that the federal courts are constantly crowded with patent infringement suits calling for injunctions, damages, and various other remedies.

This ever-present industrial disturbance is particularly troublesome because the public has no means of ascertaining in advance of producing, selling, or dealing in a commodity whether or not the same will infringe some patent thereafter to be issued, as many thousands of patents are not published and cannot be seen by the public until long after they have been applied for. For this reason all patent applications should be classified and opened for public inspection after they have been pending two or three years, particularly as many inventors and attorneys make a practice of delaying the prosecution of patent applications and the issue of patents for many years while an art or industry is being commercially developed, and this obviously presents opportunities for all kinds of fraud.

Another needless evil which causes much fruitless litigation is the fact that patent licenses and shop-rights do not have to be recorded, nor even transfers, except prior to subsequent assignment. The result of this is that it is impossible for the prospective purchaser of any right under an invention or a patent to ascertain with certainty in advance the true state of the title. This incentive for fraud can and should be remedied by providing that every transaction affecting rights to a patentable invention be filed promptly for record in the patent office for public inspection, and those not so recorded should be held void as against any subsequently interested party adversely affected thereby.

As the law now stands, Sec. 4915 of the U. S. Revised Statutes provides for the equivalent of new interference trials which means that after a would-be patentee has exhaustively litigated his right to a patent for perhaps 6 to 8 years in the Patent Office, and Court of Appeals, he may have to litigate the question over again in the federal courts. This imposes unnecessary hardship, opens the way for fraud, and discourages legitimate progressive industry and invention. The merit of such laws is seriously questioned, and it is believed that they should be repealed. When manufacturers, patentees and the public learn to co-operate, they will be.

Interpreting Operation to the Directors

Planning Department Charts Supplant Accounting Statements

By GEOFFREY C. BROWN

Chief Engineer, Jacques Kahn, Inc.

Class Number
657.524 Cost Systems
657.524:658 Cost Control

AN interesting stage in the functioning of a factory cost system is the recurrent, final one, when the accumulations of cost sheets for the month are summarized, and the resultant totals assembled and analyzed in such a way as to indicate the month's performance. This is the focal stage upon which the daily details of cost department routine converge, and during which a cost system could be said to justify its existence by revealing the comparative profit or loss from individual orders, and in a general way by visualizing the month's activity so as to indicate a wise manufacturing or selling policy for the future. Cost sheet totals may indicate the necessity for readjustments in selling price on certain lines of product, or the discontinuance of other lines on which, for some reason, such readjustments are impossible. They may indicate that manufacture at some stage could be conducted more economically—a policy of expansion in one department, or retrenchments in another—so as to cause a favorable reaction on the concern's monthly balance sheet.

"Closing the Month"

The information conveyed by monthly cost sheets is therefore fundamental, and it is eminently desirable that it be analyzed and assembled in such a way as to set forth briefly, clearly, and adequately what has actually happened, fulfilling in this way Harrington Emerson's sixth efficiency principle of "Reliable, Immediate, and Adequate Records." The process of analyzing, tabulating, and charting cost summaries is usually termed "Closing the month," a phrase that I have pre-empted as the text of this article. The following description is of actual methods employed in a New York mirror factory for the purpose of presenting this data in such a way that a picture of the month's activity—simple, and as accurate as the limitations of even a good cost system will permit—is constantly before the management, and easily accessible to the board of directors.

Articles appearing in two earlier numbers of this periodical[1] have described in some detail the complete reorganization of the factory in question. The first in the series was general in character, dealing with the installation of modern production planning methods, including a cost department, and showing how, by virtue of these changes, the unit production cost in three months dropped from \$1.53 to \$1.22, a reduction of 21.3 per cent. The second article described a thorough investigation into the factory power plant, and showed how a reduction in power plant cost of \$9100 per year was effected by bringing the power plant within the scope of the newly organized factory planning department. In this third paper, which is the final one of the series, will be set forth the manner in which the cost sheets are closed at the end of the month, and the manner in which the summarized results are tabulated and charted for presentation at the monthly directors' meeting.

The Original Practice

Previous to 1922, during which year the general reorganization was undertaken, it had been customary to hold a directors' meeting during the first week of each month. At these meetings an attempt was made to show the volume of business that had passed through the factory during the month, with the probable net profit accruing. These figures were vague hazards, having no tangible foundation other than some additions and subtractions made on the general books. In the absence of a cost system no information existed as to which orders were profitable and which were not, and the financial position of the company was visualized by means of a monthly trial balance that had no connection with inventory figures. A statement taken from the general books was usually placed before the directorate and this provided a somewhat slender basis for the discussion which ensued. The monthly trial balance figures, through their lack of connection with raw material and work in progress inventory values, were subject to wide inaccuracy. No accurate idea of the concern's actual financial position, including profits earned or losses sustained, was available until the books were closed at the end of the year—this considerable lapse of time destroying any small usefulness that information so general in character might otherwise have possessed. In a general way there was a minimum of information to present at monthly meetings, and this minimum was presented at the wrong time and in the wrong way to be of practical use.

When, as an initial step in the general reorganization, a cost department functioning as part of a central production planning system was installed, effort was concentrated on developing a method of assembling the cost summaries in such a way that a picture of the company's performance during each consecutive month of the year—and eventually of the entire year—would be always available. This under-

[1] See *Management Engineering*, May 1923, p. 307, "Turning Losses Into Profits," and MANAGEMENT AND ADMINISTRATION, July 1923, p. 67, "Lower-Cost Factory Power."

taking was simplified by the fact that the factory was small and the purchasing, sales, and administrative divisions not so remote as to preclude the accessibility of their records to the central planning office. It seemed logical, therefore, in view of the fact that the planning office was to prepare, for the monthly meeting, the final tabulations and graphical data on manufacture, to have them prepare also the monthly statement of profit and loss, and the remaining charts of monthly sales and material purchased. The final aim, in a general way, was to have not only the information on manufacture, but all information including that on purchasing, sales, and general administration prepared for the directors' meeting by the planning office.

Comparison of Predetermined and Actual Expense

A preliminary stage in installing the cost system consisted of distributing a predetermined amount of overhead expense to machines and work benches in proportion to the floor space occupied, and then calculating machine hourly expense rates by application of a predetermined number of yearly hours. The elements of power, light, maintenance and repairs, departmental supplies, supervision, depreciation, rent, insurance and taxes were thus distributed, expense amounts, and yearly hours for the previous year serving as a basis.

As the machine hourly rates, on account of their predetermined basis, are necessarily subject to some inaccuracy, a comparison of the predetermined departmental amounts, as assembled from the individual cost sheets, with the actual overhead expense for the month, and a subsequent readjustment of the hourly rates, is obviously necessary. This comparison between predetermined and actual expense was made the first stage in closing the month, and its manner of accomplishment is indicated by Table 1, an actual one taken from our files.

This table has been selected on account of the wide variations that it indicates between predetermined and actual expense. The column to the left shows, mnemonically, the factory departments. The second column shows the predetermined expense amounts as totaled from the departmental summaries on the month's cost sheets. The third column indicates the corresponding actual expense amounts for the month, and the two right-hand columns express in dollars, and as a percentage of the predetermined expense for each department, the amount that the latter varies either above or below the actual. Existing machine hourly expense rates in each department are thus readily readjusted by redistributing the additional amount where the predetermined expense is low, or by subtracting where it has proved high, this adjustment being effected in proportion to floor space with an ultimate reduction to the hourly basis.

The closing of cost sheets which represent orders completed and shipped within the month is a comparatively simple operation, because each cost sheet visualizes the completion of an order. If the closing of the month entailed merely the summarizing of these sheets it could be accomplished with facility. Unfortunately there is always a considerable volume of partially completed orders and these sheets cannot be closed because some proportion of the orders remain to pass through manufacturing stages and be shipped. Each month must, however, receive its proper allotment of raw material cost, labor cost, manufacturing expense, administrative expense, selling expense, and profit or loss on these partially shipped orders, and the

TABLE 1. COMPARISON OF PREDETERMINED AND ACTUAL EXPENSE, JUNE 1923

Dept.	Predetermined Expense	Actual Expense	Variation of Predetermined from Actual Expense Dollars	Variation of Predetermined from Actual Expense Per Cent
D G	$3,463.21	$1,987.40	$+325.37	+9
D C	....	1,050.44	....	....
D P	2,392.41	3,209.04	−806.63	−33
D M	830.07	1,116.51	−286.44	−34
D S	2,085.25	1,959.83	+125.42	+6
D B	857.39	885.58	−28 19	−3
D R	54.80	54 85	−0 05	....
Admin.	2,061.97	3,800.00	−1,738.03	−84
Totals	*$11,700.39*	*$14,063.65*	....	....

method of determining this allotment with reasonable accuracy and with a minimum of effort has been a perennial problem in the allocation of monthly costs and the preparation of monthly statements. Its solution obviously lies in the taking of a monthly inventory of work in progress and part shipments, and in accomplishing this somewhat tedious task with as much simplicity as is compatible with sufficiently accurate results.

Method of Providing for Part-Shipment

Soon after our cost system had been installed and monthly cost sheets started, one for every order entering the factory, we were confronted with this problem of instituting a systematic correction to provide for part shipments and for the remaining proportion of these orders still in progress at the end of the month. Two alternatives suggested themselves, the first of these being a physical inventory, on the last day of each month, of partially completed orders in each factory department. It was finally decided to forego this plan in favor of the simpler alternative of entering on the lower right-hand corner of each cost sheet incomplete at the end of the month, the number of pieces shipped, a summary of their manufacturing cost, their sales value and estimated profit or loss. These values were then credited to the month in process of closure, the balance of the order with its corresponding manufacturing cost being carried into the next month as work in progress.

This plan has been in operation for some months and it functions in a satisfactory manner. At intervals, say twice a year, a physical inventory of work in progress will be taken to serve as a check on the work in progress totals as indicated by the monthly cost sheets. The manner in which the latter totals are tabulated each month from the cost sheets is indicated by Table 2

The Monthly Profit and Loss Statement

The tabulation of part shipments and work in progress values is a preliminary to preparation of the monthly profit and loss statement, one of which is reproduced in Fig. 1. In referring to this statement it will be noted that the two vertical right-hand columns show part shipment values for the current month, and for the month previous, as totaled from the cost sheet entries. *The part shipment values belonging to the month previous must obviously be subtracted from the current completed cost sheet totals, and the part shipment values for the current month added in order to close the month with accurate figures.*

Fig. 1, the profit or loss statement for May 1923, shows in a simple way how this is accomplished. Cost sheet totals of raw material (glass) cost, labor cost, manufacturing expense, business expense, selling expense and total sales price, appear in the columns to the left, and represent the closure of completed orders or orders shipped within the month. The difference between total cost and selling price entered beside the word "Difference" in the illustration, is the month's profit from completed orders. In the part shipment columns will be seen corresponding values (raw material cost, labor cost, manufacturing expense, business expense, selling expense, total sales price and profit) for part shipments in the preceding month of April and in the current month of May. The profit on part shipments in April is brought to the left and subtracted from the profit accruing from completed orders in May. The profit from part shipments in May is then added to this difference and the result is the corrected profit for the month.

By following this method of subtracting and adding part shipment values to the cost sheet totals for completed orders, we have been able to submit each month a profit and loss statement that checks reasonably with the month's business appearing on the general books, adequately represents inventory values, and is drawn entirely from the monthly cost sheets.

Having prepared the monthly statement, it is necessary to assemble the individual cost sheets according to the character and value of the orders, and then analyze the component cost features of each class of product with a view to determining whether selling prices on certain of these require readjustment, or whether manufacturing cost at some stage has been abnormally high. It was our practice at first to tabulate this information, each cost analysis so tabulated showing the cost features, selling price, and profit or loss for each of the considerable number of lines passing through manufacture during the course of a month. We gradually found that this typewritten cost analysis, in order to comprehend our somewhat diversified product, would become too long and unwieldy to be of convenient use; and also that it was not sufficiently graphic to visualize simply and briefly an analysis of the month's orders. In the first article of the series we described this problem as follows:[2]

MAY 1923

		Amounts	Unit Costs	Part Shipments April	Part Shipments May
Production	Total Plates	8,601			
	Plates Machined	7,439			
	Sq ft "	33,091			
Costs	Glass Value	$ 27,207 28	$ 3 27	$ 2,397 93	$ 3,911 47
	Direct Labor	4,554 90	.53	705.97	330 71
	Mfg Expense	9,446 07	1.09	446 74	734.76
	Business "	3,777.00	43	345 81	319.64
	Selling "	4,091.73	47		
Total Costs		49,076.98	5 79	3,896 45	5,296 58
Sales		64,695.04	7.52	5,537.74	8,122.67
Difference		15,618 06	1.73	1,641.29	2,826.09
Minus Part Shipments, April		1,641.29			
Difference		13,976.77			
Add Part Shipments, May		2,826.09			
Profits for May, 1923		16,802.86	1.95		

CORRECTION AS PER INVENTORY

Total Sales	$64,695.04	Total Costs	$49,076.98
Part Shipments, April	5,537.74	Part Shipments, April	3,896.45
Difference	59,157.30	Difference	45,180.53
Part Shipments, May	8,122.67	Part Shipments, May	5,296.58
Corrected Sales	67,279.97	Corrected Cost	50,477.11
" Cost	50,477.11		
Profits, May, 1923	16,802.86		

FIG. 1 MONTHLY STATEMENT OF PROFIT OR LOSS

Columns to left show cost summary of orders completed during the month. The two columns to the right represent partially completed orders.

TABLE 2. INVENTORY OF WORK IN PROGRESS AND PART SHIPMENTS, JULY 31, 1923

	Value In Progress	Value Part Shipments	
Raw Material	$22,977.84	$4,479.01	
Stock Keeping	2,297.78	447.90	
Labor	1,286.99	235.35	
Mfg. Expense	2,139 73	631.10	
Administration	1,028.02	259.94	
Freight	......	.....	$134.33
Packing	......	.....	123.94
Commissions	......	.....	411.85
Discounts	......	.....	148.08
Totals	$29,730.36	$6,053.30	$818.20
Part Shipments	6,053.30	......	6,053.30
Total Value of Work in Progress	*$23,677.06*		
Total Cost Part Shipments			$6,871.50
Sales Value, Part Shipments			9,885.08
Profit for July Part Shipments			*$3,013.58*

It might be mentioned here that we do seven varieties of work. Each of these seven varieties is turned out in three ranges of size, with a final subdivision into four classes depending on the value of the order. We have, therefore, 84 separate classes or variables which we wish to present simultaneously on a single chart—a somewhat complicated problem at first glance.

The density chart, devised by Walter N. Polakov and reproduced in our first article,[3] has provided a very satisfactory solution to this problem and continues to be our compass in the selection of profitable lines, or in the readjustment of selling prices, or improvement of production methods on lines that show loss. This chart has been of first importance at

[2] See *Management Engineering*, May 1923, p. 310.
[3] See *Management Engineering*, May 1923, p. 309.

1923	Per Cent of Capacity Used (10 20 30 40 50 60 70 80 90)	Total Idleness	Idleness due to Waiting for Glass	Lack of Help	Material	Lack of Orders	Lack of Power	Repairs	Lack of Tools	Holiday
April $13,192.08 Total		$3,011.39	2,700.13	62.83		327.20		21.52		
3,078.69 DC&DG		1,585.53	1,585.53							
2,420.00 DP		617.12	544.93	53.21				18.98		
968.00 DM		515.73	176.37	9.62		327.20		2,54		
2,071.21 DS		393.30	393.30							
854.18 DB		——	——							
3,800.00 Bus		——	——							
May 13,861.44 Total		3,958.02								
3,719.18 DC&DG		1,829.83								
2,513.51 DP		578.18	532.70	42.70				2.78		
829.35 DM		572.58	233.94	22.74		314.19		1.66		
2,185.48 DS		309.20	309.20							
813.92 DB		——	——							
3,800.00 Bus		668.23	668.23							
June 13,438.42 Total		5,396.58								
3,463.21 DC&DG		1,987.88								
2,392.41 DP		685.88	592.06	22.49				68.46	2.87	
830.07 DM		573.59	188.09	20.75		360.64		.99	1.22	
2,085.25 DS		391.20								
857.39 DB		——								
3,800.00 Bus		1,758.03	1,758.03							

FIG. 2 GANTT IDLENESS CHART

monthly directors' meetings. It was described as follows in an earlier article:[4]

This chart presents a comprehensive profit and loss picture of an entire month's work. The values of the orders from the standpoint of quantity are indicated by the

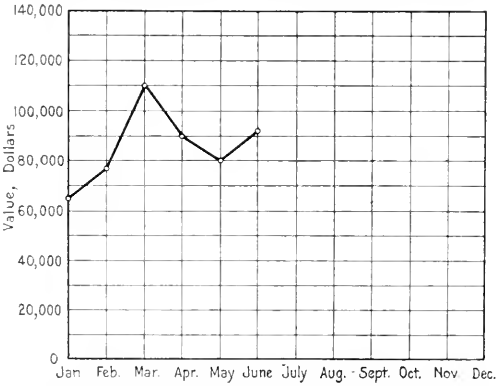


FIG. 3 CHART SHOWING MONTHLY INVENTORY VALUES OF MATERIAL IN STOCKROOM

character of certain symbols, and the class and size of product are indicated by the *position* of these symbols in respective columns of the chart. The zero line indicates the point at which total cost and selling price are coincident, or in other words, the point at which there is neither profit nor loss. The percentage of profit or loss for any order symbolized is indicated, therefore, by its position above or below the zero line, and can be read quite simply from the percentage scales at the side.

The monthly expense incurred through idleness of machines or other equipment, is charted for the monthly meeting by use of the Gantt Idleness Chart.[5] One of our idleness charts is reproduced as Fig. 2. It will be noted that we are able to present three consecutive months of idleness expense on a single page, and that the expense amounts for each department appear in respective columns, under the captions, "Waiting for Glass," "Lack of Help," "Lack of Orders," "Lack of Power," "Repairs," "Lack of Tools," and "Holiday."

Monthly idleness charts are prepared from the month's accumulation of daily idleness reports, one of which is received daily from each factory department. The idleness expense amounts are not charged against the departments, but are written off by means of special idleness accounts on the concern's general books.

Miscellaneous Graphs for the Directors' Meeting

In Figs. 3, 4, 5 and 6 are reproduced four graphs which can be said to complete a visualization of the month's business. These charts are prepared by the planning office and the statistics are drawn entirely from cost sheets. Figs. 3 and 4 are the two inventory charts respectively of raw material and work in progress. The vertical co-ordinates show inventory values in thousands of dollars, while the abscissae indicate months of the year. These charts visualize the inventory to date, and provide simple inventory pictures which may be filed at the end of the year and during the following year referred to for purposes of comparison.

Fig. 5 shows the monthly volume of production and the unit production cost. This interesting graph, like the density chart, was devised by Mr. Polakov, and its value lies in the clearness with which the monthly fluctuations in unit cost are represented in their rela-

[4] See *Management Engineering*, May 1923, p. 310.

[5] See "The Gantt Chart," by Wallace Clark, p. 32.

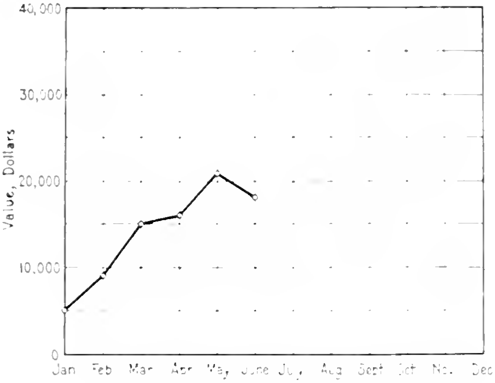


FIG. 4 CHART SHOWING VALUES OF WORK IN PROGRESS ON THE LAST DAY OF THE MONTH

tion to the monthly volume of production. The graph is partitioned into 5 subdivisions, each representing six months—the years 1922, 1923, and the first half of 1924 being thus charted in a single presentation. The vertical co-ordinates are the unit costs in cents per square foot, and the monthly output in thousands of square feet manufactured. The abscissae represent in months, the two and a half years spanned by the chart. The heavy line shows the monthly fluctuations in unit cost from January 1, 1922, until June 1, 1923, while the lighter line represents the total output in square feet from month to month. The effect of modern planning methods upon unit cost is very clearly presented by this important chart. During the year 1922, our active reorganization period, the unit cost shows a gradual drop from 57 cents to 48 cents per square foot, and this irrespective of any rise or fall in the monthly volume of output. It will also be noted that this low level of unit cost has been maintained during the first six months of the present year.

Fig. 6, the last chart in our group, shows simultaneously, the monthly manufacturing cost and sales values during the first six months of the present year. This graph indicates the trend of business and establishes a relation between this trend and manufacturing costs. On account of its general character it should be studied in conjunction with the preceding chart, Fig. 5.

Summary

A summary of the tables and graphs prepared by the planning office, in closing the month, is as follows:

(a) A comparative table of the month's predetermined and actual overhead expense.

(b) A table of part shipments [illegible] and work in progress values.

(c) A monthly statement of profit and loss.

(d) A density chart showing graphically a cost analysis of the month's orders.

(e) A Gantt Idleness Chart showing by departments the monthly expense incurred through idle equipment.

(f) Four simple cross-sectional charts which visualize monthly variations in:
1. Value of raw material in stockroom.
2. Work in progress inventory values.
3. Volume of output and unit costs.
4. Total cost and sales.

These statistics, as intimated, are prepared entirely by the factory planning office from the monthly cost sheets and quite independently of any figures appearing on the general books. We consider that they provide a satisfactory picture of the month's work.

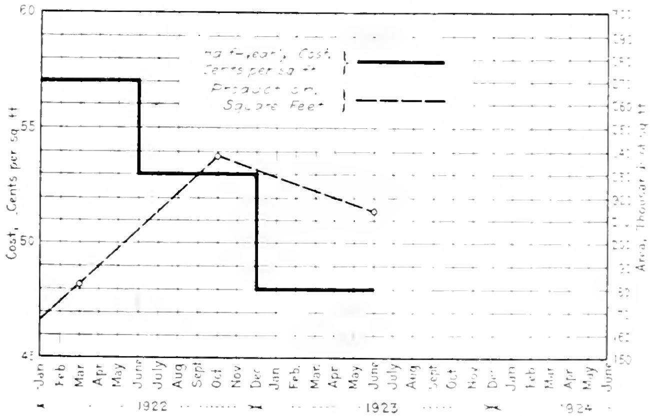


FIG. 5 COMPARISON OF MONTHLY PRODUCTION VOLUME WITH UNIT COST FLUCTUATIONS

It is interesting to note that, through the introduction of modern planning methods, unit costs have steadily dropped.

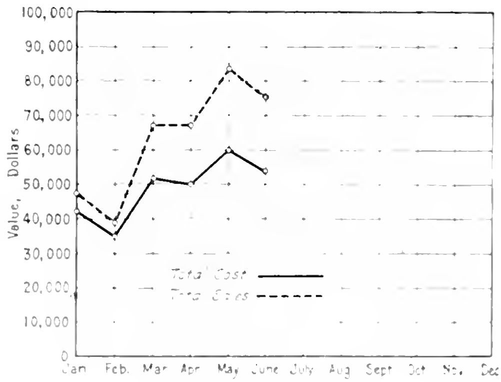


FIG. 6 TOTAL COST AND SALES

and establish an adequate basis for the determination of future policy. Information which lies entirely within the scope of the treasurer's department, such as variations in bank balance, outside investments, income tax statistics, etc., must, in their nature, come from the general books, which also continue to show in a cumulative way, the year's business. But the figures which have immediate, analytical value, and which show from month to month what has been done and what can be done, are drawn entirely from the cost sheets, and provide overwhelming justification for the expenditure incidental to the introduction of modern planning methods.

The charts which have been described and reproduced in this article are now accepted with little question at the monthly meetings. This was not always the case. In the earlier stages of our reorganization they were treated with aloofness by the directorate, and the traditional statement from the accounting department, with its vague and inadequate presentation, was reverently passed around and gravely discussed. As the simplicity and the authenticity of the new records were gradually realized, their acceptance followed and they have now supplanted the old form of presentation. In doing so, they are providing an instrument, previously lacking, by virtue of which recent performances may be accurately gaged, and new administrative policies properly formulated.

Easy Handling of Heavy and Awkward Loads

Class Number
658.281 Industrial Trucks

LOADS which are awkward for a gang of men to pick up may be quite easily handled by an industrial truck which carries its own hoist. The pair of car wheels and axle in the accompanying photograph are only one example of the facility with which work of this nature can be accomplished. This load is so heavy that even if it were in convenient form, several men would be needed to lift it and place it upon a truck. But a crowd of men would find it difficult to take hold of such a piece in sufficient numbers to lift it and deposit it safely on the truck.

Advantages of the Hoist Truck

The hoist which is part of the truck has no such handicap. A chain knotted through each wheel, with a ring to go over the hook of the hoist, enables the truck operator, by directing the current of his truck battery into the hoist, to swing the heavy piece in the air and let it find its own balance. One man can easily guide the wheels as they settle down upon the truck, or the hoist operator himself may be able to handle them alone from his station at the levers. The beam of the hoist can be rotated at will around the cylindrical post which supports the hoist, and simultaneously the chain can be lowered so that the load finds its own place on the truck.

With the apparatus shown, two men or even one man can pick up, load, transport, and deposit heavy, awkward loads that under old-fashioned methods would require a large crew of men and would take several hours' time.

The truck in the illustration has other advantages beside its lifting ability. It can go practically anywhere that a gang of men can go in numbers large enough to do the work. While cranes and hoists may be installed in various buildings, and even outside where materials are regularly handled, very often the need for a hoisting device arises at some other place. If the plant has locomotive or caterpillar cranes, they can do the work, but often they cannot get to the desired point because of their size, and they can rarely enter buildings. Moreover, not every plant is equipped with these cranes. Hence, the industrial truck hoists, which are independent of most limitations on other classes, are valuable in many plants.

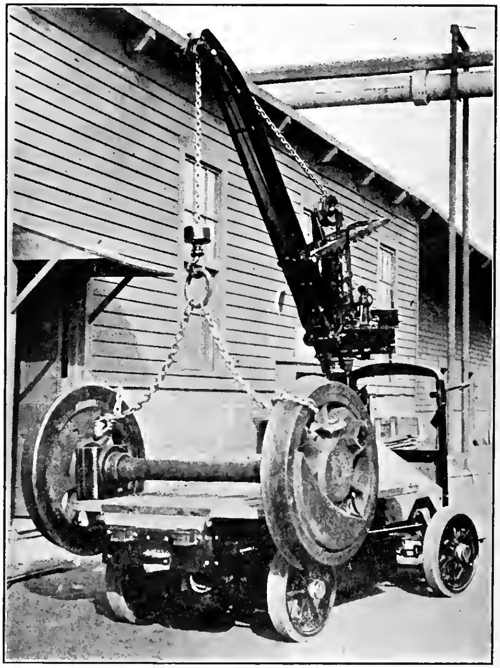


FIG. 1 AN INDUSTRIAL TRUCK CARRYING ITS OWN HOIST

Day laborers are nearly as highly paid now as mechanics, and, like much of the work of a machinist, their work can be more economically performed by mechanical methods.

The Effect of Plant Location and Machine Grouping on Profitable Operation*

V—"The Organization of Modern Industry"

By DEXTER S. KIMBALL

Dean, College of Engineering, Cornell University

Class Number
658.16 Organization of Industry
658.56 Machine Grouping

MANUFACTURING industry grows naturally out of the needs of congregated peoples. In a new country, therefore, the first industrial enterprises are found close to the newly-founded towns and villages and the advantages and inertia of such an early start may long outweigh the advantages of more favorable locations. As a new country, like the United States, becomes more thickly populated, as new resources are discovered, and as transportation facilities become more efficient and lower in cost, the location of a new industry ceases to be a matter of inheritance or personal judgment, but becomes a subject for statistical investigation and economic determination. The scope of these articles prohibits an extended discussion of this important matter, but the interested reader will find an excellent treatment of the subject in the volume on manufactures in the Twelfth Census of the United States.

Similar observations hold true for the design of industrial plants where the inertia of methods that have proved to be successful in specific instances often stands in the way of progress. Until very recently, it was not unusual to see large additions made to growing factories with little or no inquiry as to whether the increasing size of the plant had made methods other than those in use more desirable. And it was quite common practice to see new plants built, using some older establishment as a model with little or no thought as to the need or economic necessity of using radically different methods and consequent radically different factory arrangements. The design of industrial plants has become a well-defined specialty, a discussion of which is, again, beyond the scope of these articles. There are, however, certain basic principles that affect plant design and arrangement and which have their roots in shop processes to which attention will be directed in this article.

There are two distinct methods of grouping machines that greatly affect both the general arrangement of the factory and its administration. In the first method all machines of the same kind and approximate size are grouped together. Thus, all lathes up to 20-inch

*Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION, July 1923, p. 17; August 1923, p. 165; September 1923, p. 333; October 1923, p. 437.

Courtesy Singer Sewing Machine Company

FIG. 34 TOOLROOM OR SHOP IN WHICH AUTOMATIC MACHINES ARE BUILT
This room is 240 ft. wide by 600 ft. long. Note various kinds of machine tools, as planers, shapers, and radial drills.

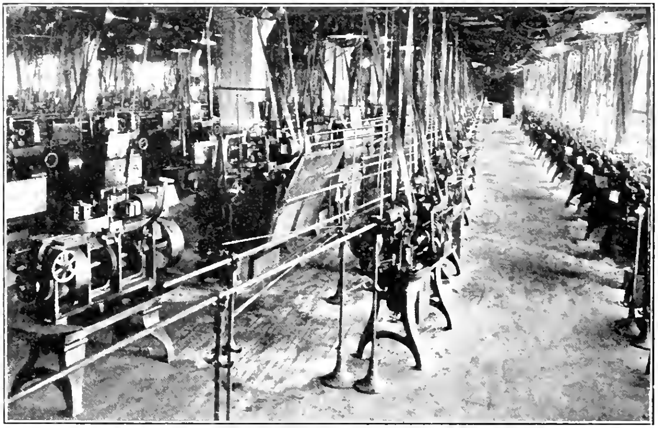
swing may be placed in one group, all small drilling machines in another, all semiautomatic lathes in another, and so on. That is to say, the arrangement of the tools is based upon the processes to be performed. In the second method the arrangement is based upon the character of the finished product. Thus a department making arc lamps would have its own equipment especially adapted to its needs, another department building transformers would have its own special equipment, each department entirely independent of the other, and each in a large measure self-sufficient so far as machine processes are concerned.

It is obvious that the first method is, in general, the most economical, if it can be applied. Fewer tools of a given kind will be required since the possibility of keeping all machines in continuous operation is a maximum under this method. The cost of superintendence will also, in general, be less. It is to be specially noted that the success of this form of machine grouping rests to a large degree on the accuracy with which the operations are performed. This, again, depends upon the equipment of standards and gages. Modern refined methods of machining, especially by grinding processes in connection with accurate measuring instruments, have made this form of machine grouping possible to an amazing degree as compared with former methods. Sometimes it is not possible or desirable to make a very rigid application of this principle, and many departments arranged primarily for one kind of work often need a few tools of other kinds for emergencies or for convenience. The most highly developed examples of this form of arrangement are found in continuous industries and mass-production plants.

It may also occur that a careful consideration of the merits and disadvantages of both methods of grouping will often result in compromises that will save money and facilitate production. The practice of grouping tools and process according to the character of the finished product is still followed in plants of the old order where the growth has been of an accretionary character, complete new equipment of tools being added for every new product. The inertia of human nature and the resistance to change so commonly displayed by foremen and superintendents often makes it difficult, if not impossible, to rearrange these old plants even though the gains to be made are obvious.

In former days the industrial worker in the skilled callings was looked to for a large amount of the initiative in production, and he was expected to be competent to operate all the comparatively simple machines of his calling. Division of labor had not as yet become an important factor in industry and each workman performed all the necessary operations on each piece of product moving the work from machine to machine as necessity required. Under this old form of organization machines were not assigned to particular individuals, but were common property, so to speak. Many small shops doing repair work are still being operated in this manner, the machine being stationary and the worker and the work moving.

As the principles of quantity production, that have been discussed in the preceding articles, became better known, and as the quantity to be produced made these principles easy of application, specialization naturally followed. More and more the worker was expected to become proficient in the use of only one tool, or process, and the practice of moving the worker with the work was abandoned. For many years this practice was followed without change and this movement was hastened no doubt by the introduction of more complex and more highly specialized machinery. The general idea that the worker and the machine should be stationary and that the work should move was also advanced by the examples of continuous-process industries. In such a plant as an ore-reducing mill, a flouring mill, or any of the many industries that rest upon chemical reactions, where the material treated *flows* in a continuous stream through a series of machines or operations, both men and machines are fixed and the material moves. The assumption is a quite natural one where large machines are to be employed.



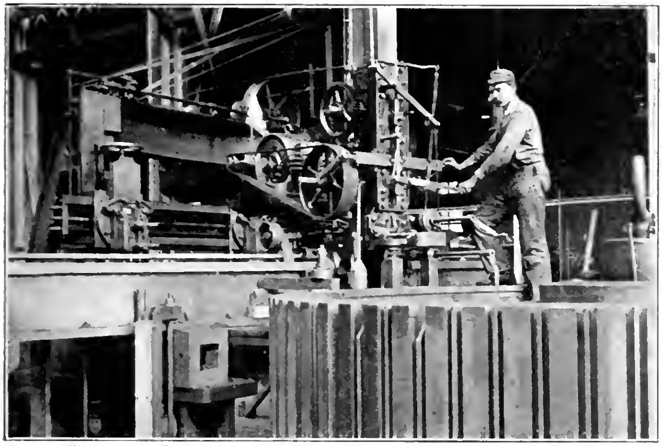
Courtesy Singer Sewing Machine Company

FIG. 35 SCREW MACHINE DEPARTMENT OPERATING MORE THAN 200 HIGHLY SPECIALIZED MACHINES

Experience with modern methods, however, has shown that this is not necessarily the best way to do all industrial work. As a matter of fact, there are three variables in any manufacturing operation, namely, the work, the tool, and the workman, any one of which or any combination of which may be fixed or may move. The best economic solution of many problems in modern production involves a careful consideration of this fact, and some interesting departures from the old ideas have been brought about by such consideration. In a restricted manner the problem is an old one among designers of machine tools. In the lathe and vertical boring mill the work rotates while the tool has a motion of translation. In some forms of horizontal boring machines, the work is stationary while the tool rotates and has also a translatory motion. In some of the more complex automatic or semiautomatic machines the work rotates in a fixed position while a series of tools are moved against it in successive operations. In other machines of this type the work is moved from station to station, the tools rotating in fixed positions, except as they are fed against the work. Many other similar illustrations of this problem are to be found in this field.

The size of the work to be performed may greatly influence the decision as to whether the work, the man, or the tool shall be moved. Thus where a comparatively small number of large parts are to be inspected, it is obvious economy to have the inspector move from place to place carrying his instruments with him. If, however, a large number of small parts is to be inspected, it will, in general, be better to move the work to an inspection room where the inspector and his staff are located permanently and possibly with measuring instruments also in fixed positions. Or, again, it may be that a compromise between these extremes may be best. Thus the parts to be inspected may be deposited at inspection stations as they move through the various processes and the inspector may visit these stations at regular intervals, carrying his instruments with him or not as the condition may warrant.

An interesting problem of this kind arose a few years ago in connection with the construction of large electrical generators. Prior to the advent of the steam turbine the rotor of a large generator was often placed directly upon the shaft of a large slow-moving steam engine. In order to obtain enough poles to produce the required alternations the diameter of these rotors and the resulting diameter of the stationary frame were necessarily very great, generator frames 30 ft. in diameter, or more, being not uncommon. These large frames were of a necessity made in segments and bolted together. Machine tools of the ordinary stationary type capable of machining the ends of these large segments in the usual manner by moving the work would have been very large and costly to construct and their use would have been intermittent and infrequent. Large machine floors covered with heavy cast iron sole plates and resting upon firm foundations were, therefore, constructed. These plates were made in sections. The surface of each section was carefully machined and the edges of adjoining sections were carefully fitted together so as to form a large, true plane surface. The surface of this great plate was fitted with grooves or slots into which bolts could be slipped for the purpose of holding the work stationary and, also, for securing the portable tools of various kinds. The piece to be machined could be easily aligned with reference to the surface of the plate and a portable tool, placed in proper position, could perform the necessary machining operations. Some very large portable slotting, milling, and drilling machines were constructed for this work and the accompanying illustration will give some idea of their size and character. Each machine was fitted with a large eyebolt so that it could be lifted and transported by an overhead traveling crane, its size and weight making transfer in any other manner out of the question. These portable tools were driven by independent electric motors attached to the machine in some convenient place so that the machine could be placed in any position desired without reference to driving mechanism, such as belts, shafting, and pulleys. This procedure is obviously an example on a large scale of making the work stationary and moving the worker and the tool.



Courtesy Westinghouse Electric and Manufacturing Company
FIG. 36 AN EXAMPLE OF A PORTABLE MACHINE TOOL

In ordinary foundry work the molds in which the castings are made are placed in stationary positions on the foundry floor near the place where they are made. The molten metal is carried to them from the cupola in ladles. This procedure must always be followed in making very large castings, but where large numbers of castings, small in size, are to be made it may be more economical to carry the molds to the melting furnace. Such a method is followed by the Westinghouse Air Brake Company in making brake shoes. The molds, as soon as made, are placed on a long traveling table which is in continuous motion and which carries them to the melting furnace. Here they are filled with molten metal from a ladle, arranged so as to travel with the table while the operation of pouring is taking place. After pouring, the molds are carried away by the table, remaining upon the table long enough to permit the castings to cool sufficiently to be shaken out of the molds and separated from the sand. Larger work has also been handled in this manner, but the table is usually stopped when pouring is taking place. Obviously this is an illustration of moving the work and keeping the worker and the tool stationary, reference being made only to the process of pouring and not to the work of forming the mold.

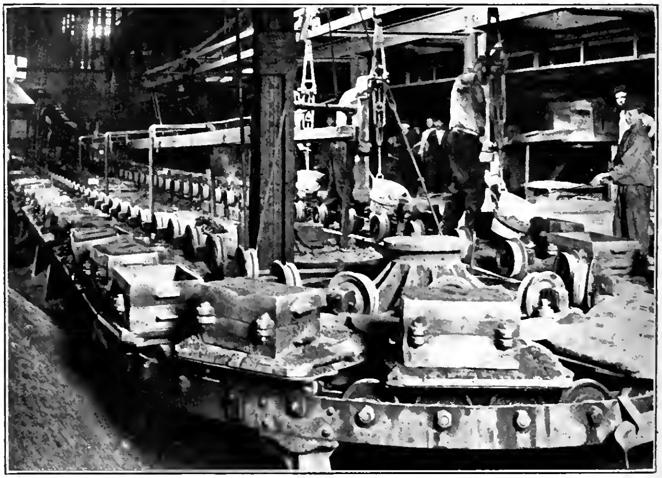
It is interesting to note that the *quality* of the product may also affect the portability of work or tool. Thus, in making steam-boilers it is customary to require that all plates shall be riveted together on stationary machines, and to prohibit all hand-riveting or riveting by portable machines of any kind because superior workmanship cannot be secured in this manner. In such cases the boiler shell must be moved to accommodate the riveting machine and the handling devices necessary to provide such free movement become an important part of the equipment. In ship-work and structural steel work, on the other hand, both handwork and portable riveting machinery are not only permissible, but absolutely necessary to the prosecution of the work.

These general principles have received considerable attention in connection with the assembling of machines and structures. The older and most common conception of assembly operations is simply to gather all component parts together at some convenient spot and then assemble the machine or structure in proper order. This method is the logical one for such structures as buildings, bridges, ships, etc., and for heavy machinery, such as large engines and heavy machines in general. Usually in such cases the same set of workmen perform all the assembly operations. Such men would, in general, be required to have a complete knowledge of the machine to be assembled and would need to be skilled in the use of several tools and instruments.

Suppose, however, that a large number of machines is to be assembled so that a considerable number of assemblies must be in operation simultaneously, and a large number of assembly sites must, therefore, be provided. It would be possible, of course, to assign a group of "all around" mechanics to each site and to proceed as described in the preceding paragraph. Instead of so doing, however, suppose that the entire group of assembly men required is divided into specialized groups, each group having special skill in a few assembly operations and moving from assembly site to assembly site as occasion requires, carrying their tools and instruments with them.

Thus, suppose that small engines are to be assembled. The first assembly gang might align the bed upon the assembly floor and set the frame and cylinder in line. The second gang might fit the main shaft to its bearings. The third gang might assemble and fit the piston, piston rod, crosshead, and connecting rod. The fourth gang might assemble and set the valve gear and so on, one gang succeeding another as fast as the operations were completed. It will be obvious that for best results, the division of operations must be so arranged that the time required by each assembly gang is about the same and enough stations must be in operation so that when the first gang has completed its operation at the last station, complete assembly has been accomplished at the first station. In other words, for best results each set of performances must be in operation at the same time and all assembly gangs must move at the same time. This arrangement is nothing more than an application of division of labor and this method has been used with success in certain phases of mass production, the work being stationary and the worker and his tools moving from place to place.

Methods such as these are obviously best suited to the assembly of large units. If the units are small and light enough to be moved with ease, it may be more advantageous to obtain the advantages of division of labor by moving the work and keeping the worker and his tools stationary. This is especially true where each operation requires the services of only one individual and where refined tools are necessary for the work. Small apparatus made up of a large number of parts



Courtesy Westinghouse Air Brake Company

FIG. 37 FLASK CONVEYER FOR CONTINUOUS POURING IN A FOUNDRY

are usually assembled by passing them from worker to worker, each man adding his own peculiar contribution to the product. In many instances it is possible to use simple conveying devices, such as belts, to move the parts from worker to worker. While, in general, such methods are applicable only to light work there are a few exceptional cases where they have been applied successfully to fairly heavy construction. A few such cases will be discussed, briefly, later on in this article. Before doing so it will be necessary to call attention to another important principle in design and construction.

In simple machinery, such as a steam engine, the procedure in assembling the several parts is self-evident, but in more complex apparatus this is not true if designed in the ordinary manner, having simply in mind the possibility of the successful performance of the machine. Most complex machines are made up partially or wholly of combinations or groups of parts that can be assembled independently and without reference to other similar groups or independent parts. These several combinations and other parts, again, can be assembled into the finished machine. Thus the governor of a simple steam engine can be assembled without reference to any other part and then placed in position. The problems met with in building automobiles, watches, typewriters, and similar complex products have accented the importance of this principle in such work. It should be noted that these

Courtesy of the Worthington Pump and Machinery Corporation

FIG. 38 AN ASSEMBLY FLOOR FOR LARGE WORK

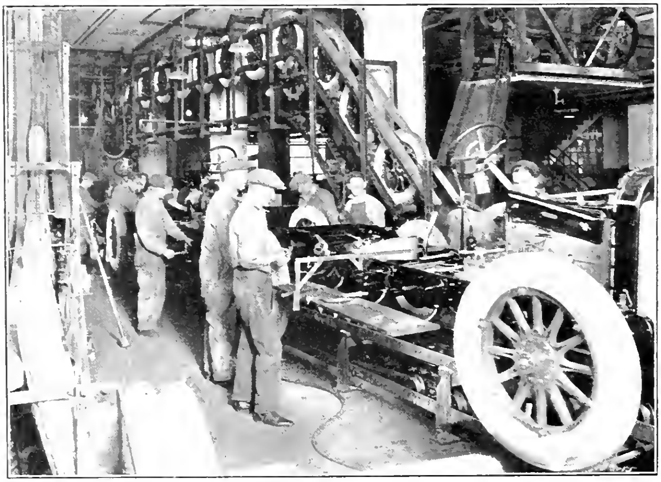
unit assemblies may or may not be made in the same factory. Thus, in automobile construction the starting and lighting sets are usually bought from factories that specialize in this particular apparatus. Many other automobile parts and accessories are purchased from specialists by most builders of automobiles and the practice is now quite common in many other industries. In some instances, this principle has been carried so far that the factory is merely an assembling plant, unit parts and combinations being furnished by specialized industries. The importance of standardization and interchangeability discussed in the last article is obvious in connection with this kind of work.

While the principle of unit assembly is well established in some lines of work it has not received as much attention as it merits at the hands of designers of complex machinery. Aside from the obvious advantages in manufacturing and assembly noted in the foregoing the principle of unit assembly is of great advantage in making repairs. All are familiar with complex machines where, in general, a large part of the mechanism must be dismantled to get at any single part. In such machines as typewriters, automobiles, and adding machines it is of great importance that the construction be such as will permit any part or combination of parts to be removed and repaired without dismantling an excessive number of members. It will be seen, therefore, that the problem of easy and cheap assembly is largely, also, a problem in design and a wise designer will always make a careful study of the unit assemblies into which it is most advantageous to divide the machine. It will be clear, also, that the character of these units will greatly affect the arrangement and sequence of assembling operations.

These principles and methods have received a great deal of attention from builders of automobiles. In almost all the large automobile factories the thousands of parts that pass through the machine floors flow to the particular unit assembly to which they belong. Thus all cylinders, cylinder heads, pistons, piston rings, crankshafts, connecting rods, and other parts that belong to the engine are carried to the motor assembly floor. In small shops where a comparatively small number of engines are to be assembled, it is customary and usually most economical to locate the main frame permanently on erecting blocks and bring to it all parts necessary to assemble the complete engine. One set of men often does all assembly operations, though if there are enough assembly blocks the workers may be divided into special gangs and moved progressively from block to block, as has been described.

Where large numbers of machines are to be assembled "progressive assembly" as it is usually known, is becoming quite common and automobile builders have done much to advance this very economical method. In assembling automobile motors by this method the main frame and cylinders which constitute the principal part of the engine are attached to the incoming end of a long moving carrier as shown in the accompanying figure. The cranks, pistons, heads, and other auxiliary parts of the motor are supplied in proper sequence and at the proper locations along the carrier. The work of attaching these several auxiliary parts to the main frame is divided among several men or groups of men who stand at assigned places along the side of the carrier, the spacing of these groups being such that each man can move along with the chain a sufficient distance to accomplish his task, returning to his original place when this is accomplished in time to begin work on the next unit as it comes along on the carrier. As the motor moves slowly along, therefore, these groups of men assemble the several parts of the machine in a "progressive" manner, each man or each group performing a fixed given task so that where the main frame reaches the end of the carrier, the motor is completely assembled. The work is inspected at fixed intervals as it moves along and is fully inspected and tested at the end of the assembly. It will be clear that this method is capable of application to a wide range of work provided there is quantity enough to justify the cost of the carrier and the necessary division of labor.

The final assembly of automobiles is conducted in a similar manner in some factories and this process is far more interesting and spectacular than any other progressive assembly. For this work the moving carrier must be at least 600 ft. long, and it moves at the rate of 4 to 6 ft. in a minute. One of these carriers in operation is shown in the accompanying illustration. As there are many cars moving along at the same time, as high as 300 cars have been assembled on one carrier in 8 hours' time. At the starting end of the carrier a front axle unit and a rear axle unit are assembled on a frame and the combination is attached to the carrier and started on its way. The wheels roll along in guiding grooves and carry the frame, the carrier simply drawing the frame along with it. As the frame moves along successive groups of workmen attach the wheels, steering gears, engine, gasoline tank, radiator body, mud guards, etc., all in a prearranged and logical sequence. The many minor operations incident to the complete assembly such as putting gasoline into the tank, oiling all of the bearings, in short every operation necessary to complete assembly, are carried out successively as the frame moves along until as it nears the end of the carrier it has become a complete automobile. The several parts and combinations of parts are supplied regularly and at the proper place in the assembly line. Some of these parts arrive on overhead carriers, some come down chutes from upper floors, but all arrive at the exact place where they are needed and they arrive in such quantity that there is no waiting for parts.



Courtesy Buick Motor Car Company

FIG. 39 ONE OF THE STEPS IN PROGRESSIVE ASSEMBLY OF THE BUICK SIX-CYLINDER CHASSIS

At this point the tired wheels are delivered and mounted and the running boards are attached.

In some progressive assemblies the engine is started and tried while the automobile is still on the carrier. Near the end of the carrier the rear wheels engage with a pair of large grooved wheels that project above the floor. These wheels are driven by an electric motor and through them the rear wheels of the car and the entire chain of mechanisms including the engine can be set in motion to make sure that everything is correctly coupled and in running order. The car is then started under its own power and moves along away from the carrier. It is startling to see the sureness with which these new cars start off at the first trial; rarely do they refuse to function at the first attempt. The work of assembly is inspected at intervals as it progresses and after assembly is completed it is again thoroughly inspected and tested before shipment. In some cases this final inspection includes an actual test on a road under actual running conditions.

An interesting adaptation of these methods is found in locomotive assembly. Usually the assembly floor of a locomotive shop is fitted with short sections of standard-gage tracks, laid *transversely* of the shops, upon which the wheels can be placed as a foundation. On these again the frames are assembled, the boiler and engines are bolted in position and the many other details and connecting parts coupled up. Where the locomotive is fully assembled, it is picked up bodily by an overhead traveling crane and carried to the test floor which is usually at one end of the shop. Here the locomotive is fully tested, the boiler is covered with non-conducting material to retain the heat, the sheet metal jacket for retaining this material is put in place and the finishing touches in the way of painting and lettering are applied. The locomotive is then run out of the shop on to the yard tracks.

In building very large locomotives, particularly the monster Mallet Compounds that may weigh as high as 300 tons or more, the method of transferring the engine by an overhead traveling crane is not an easy matter and is attended by some risk. At the new erecting shop of the Baldwin Locomotive works at Eddystone, Pennsylvania, special provision has been made for the erection of very large locomotives. In this shop the foundation tracks are laid *longitudinally* with reference to the shop, and the locomotive is moved along upon the rails moving thus from department to department and arriving in its finished state at the end of the floor. The general idea of progressive assembly is the same as described for automobiles, but the division of labor is not nearly so great.

A marked distinction, furthermore, is that the *time* elements in this assembly are not governed mechanically as in the case of automobile assembly. In the latter case, the moving carrier acts not only as a means of transferring the work from operator to operator, but acts also as a *pace-making device* for the workers. This feature is not peculiar to this particular apparatus, but is to be found in many continuous process industries where processes are arranged in series and the rate of production is dependent upon the machines rather than upon the speed of the operators. Devices of this kind must be carefully studied if the work assigned is to be properly proportioned and the time allowed for each operation within human endurance.

(To be continued in the December issue.)

Planning—Its Place in Cost Control

"Increased Profits Through Control of Costs"—Article Three

By R. W. DARNELL

Comptroller, Ritter Dental Manufacturing Company

Class Number
657.524:658 Cost control
658.51 Planning

IN any manufacturing plant where the operations are at all complicated it is necessary to plan the work. Some one must do this, whether it be the superintendent, the foreman, or the workmen. If the foreman is given the responsibility of planning his work, he is going to spend a great deal of time "chasing" stock, tools, etc., as well as determining what jobs to run next. As a result he does not have sufficient time to look after his men, and both production and quality suffer greatly. Any real foreman has all he can properly attend to if he sees that his men are kept busy, that they are turning out sufficient production, and that the quality of their work will pass inspection.

The planning of the work itself should be placed under one man or in a planning department, and this, with the proper planning system, will relieve the foreman of this serious responsibility and allow him to devote all his time to his department.

One of the principal functions of planning is to produce a given schedule with the smallest amount of capital tied up in inventories, and to make the greatest number of turnovers of that inventory possible in the period of the schedule. The fact that a factory never has any shortages, either in raw material or finished parts, and that its managers never have any difficulty in maintaining their scheduled output, does not necessarily mean that they have an efficient planning system. If they have enough capital to tie up in inventories, they can, regardless of any mishaps in the factory, always have enough stock to work on; but if they are carrying twice the amount of stock necessary and using twice the capital that should be required to produce this result, they have a very weak planning system.

> **The problem of planning is so to route the product that it will go through the factory with the least expenditure of time and money, and so to schedule it that the capital tie-up in inventories will be kept at a minimum.**
>
> **A planning system is a dividend payer in any plant. Its essential records, when accurate, provide a foundation for the cost system which then becomes a by-product of the factory system.**

During the past four or five years when carrying the same quantity of inventory as in other years meant from two to three times the capital outlay, a great many manufacturing concerns have not had, and could not obtain, the capital to manufacture under such conditions. This meant that they were forced to adopt methods of reducing their inventory quantities to one-half of what they were in pre-war times, while still producing the same schedule, so that they need not be held up continually waiting for material from outside sources and from their own manufacturing divisions. In order to do this they were compelled to keep a much closer watch over their materials, and both buy and manufacture more intelligently to avoid piling up stock that would not perhaps be required for months.

When considering standards careful attention must be given material, for this is one of the most important, and in some industries, one of the most difficult elements of standard cost. Where the product is at all varied or complicated, a very detailed record is necessary if material is to be charged correctly into the cost of manufacture. Not only will proper material standards and specifications be of great value to the cost system, but they are indispensable to the planning system.

The planning department when issuing shop orders should be able to determine very closely the amount of material to requisition from rough stores to produce a given quantity of parts. Sending out the correct quantity of stock gives the great advantage of uniform quantities completed on orders; thus avoiding the necessity for requisitioning additional material from stores or returning material which has been drawn beyond the quantity necessary to complete the order. This tends to lessen confusion and cut down handling expense.

Where a great many parts are made from the same size stock, it is sometimes very difficult to place purchase orders for material intelligently unless the records show in just what quantities it is used. And, where several articles are manufactured a record is necessary showing where each size and kind of material is used and in what quantity. Unless such records are at hand, there is bound to be an unbalanced condition in rough stores.

In order to organize a system of material specifications, three principal records must be maintained:

1. Piece Part Specification.
2. Rough Stores Specification.
3. Assembly Specification.

The piece part specification shown in Fig. 4 is the

PIECE PART SPECIFICATION RECORD

DATE 8-24-23 REPLACING ISSUE OF 4-9-23

NAME Screw, special 4 - 48 x 3/16 long flat head brass for controller bottom NO. P 368

PURCHASED No.

MATERIAL Brass rod 3/16 dia R 8 AMOUNT EACH .0025 lbs.

REMARKS

APPROVED BY P. C.

USED ON	QUAN	USED ON	QUAN	COMPOSED OF: PART	QUAN	PART	QUAN	YEARLY REQUIREMENTS: USED ON	QUAN	YR REQ	YR REQ
244 G 6	2	148 G 1	6								
272 G 2	4	148 G 9	6					Mod "C" Engine A C	16	76800	
272 G 3	4	149 G 2	6					Mod "C" Engine, D C	18	43200	
401 G 2	3	149 G 7	6					Lathe, A C			
410 G 1	3	149 G 9	6					Lathe, D C			
430 G 1	1	151 G 8	2					Compressor A C	10	17000	
580 G 1	3	158 G 1	6					Compressor, D C	10	7000	
		160 G 1	4					Rotary Converter			
		160 G 2	4					Spray Warmer			
		168 G 1	2					Unit Mod. "B", A C	20	34000	
		173 G 4	7					Unit, Mod "B" D C	20	14000	
		174 G 1	8					Dist Panel Mod "B"	7	7000	
		174 G 20	8					X Ray	1	2000	
		207 G 2	2					Chair			
		224 G 3	2					Tri-Dent	13	78000	
		224 G 4	2					Total		279000	
		224 G 5	2					Minimum Quantity		25000	
								Quantity to Order		100000	

FIG. 4 PIECE PART SPECIFICATION RECORD

first record to compile. A card is made out for each part number giving a complete description of the part. The kind and size of material from which the part is manufactured is indicated, together with the quantity each piece requires.

The example shows that P-368 is made from 3-16 in. brass rod and that it requires 0.0025 lb. to make one piece. This weight includes all scrap such as bar ends and cut-offs, as it is an automatic screw machine job, and there is a certain amount of stock which is lost in the operation of cutting the finished piece off the bar.

The weights are first determined by taking the blueprint of the finished part and securing the over-all length. To this is added the cut-off and a certain percentage to take care of bar ends. This, together with the standard weight of metal, gives the theoretical weight. These weights are then carefully checked with actual machine performance to arrive at a standard weight per piece.

On the left-hand side under the lower section of the form are listed all the places where this particular piece part is used and the quantities used in the particular assembly under which it is contained.

On the extreme right-hand side of this form is a space allowed for the compiling of the yearly requirements of this piece part. For instance, under the illustration shown are listed 16 of these parts used on Model "C" Engine, A. C., 18 are used on Model "C" Engine, D. C., etc. By extending these quantities with the yearly schedule of production, the yearly requirements of this part for each article of equipment are found; and by totaling the requirements on each article, the total yearly production for the part is obtained.

The third section of this form is brought into play when the form is used for assembly specifications and will be explained a little later on.

The piece part specifications can be made up with as many copies as may seem desirable, depending upon the departments having use for a record of this kind.

Knowing what production must be gotten out over a given period of time, it is comparatively easy to set the minimum quantity which is to be carried in stock as well as to establish the quantity to order. Of course, the minimum quantity to order depends upon the size of the cushion necessary to maintain a balance of stock, and the quantity to order is also governed greatly by the conditions in the machinery departments themselves. The length of set-up on a great many jobs determines the order quantity, because on some automatic machines, where it takes from one-half a day to a day to set the machine up, it would hardly pay to run a month's supply or two months' supply if it were only going to take 8 or 10 hr. to run that quantity.

Using the piece part specification record as a base, the rough stores record is next made up.

It has been found desirable to place numbers on each item of rough stores and use these numbers when requisitioning stock from stores. When articles of rough stores are handled by description, errors are very often made in filling requisitions and these are apt to prove costly. By the use of a number, however, the articles of rough stores become as easy to handle as are the ordinary piece parts.

Under Fig. 5 is shown an illustration of the rough stores record, showing that R-138 calls for No. 22 gage sheet brass, No. 8 hard, 10 in. wide x 8 ft. long. On the left-hand side of the lower section are listed all the parts which are made from this stock, together with the weight of stock going into each part. On the right-hand side are shown the yearly requirements.

DEPT. COPY 46

ROUGH STORES RECORD

NAME Brass, Sheet #22 Ga. 8# hd. 10" wide x 8' long NO. R 138

DESCRIPTION

REMARKS

P 1284 added

WEIGHT PER DATE 1-24-23 REPLACING ISSUE OF 12-14-22 APPROVED BY P. C.

USED ON	AMOUNT	USED ON	AMOUNT	YEARLY REQUIREMENTS: USED ON	AMOUNT	YR. REQ. 1-3-22	YR. REQ.
P 90	.0012 lbs.	P 406	.0032 lbs.				
P 100	.0016	P 711	.0016	Mod "C" Engine A. C.	.17 lbs.	408 lbs.	
P 120	.0195	P 830	.0042	Mod "C" Engine D. C.	.132	132	
P 154	.0015	P 1003	.0016	Lathe A. C.	.039	70	
P 159	.0082	P 1119	.0061	Lathe D. C.	.024	19	
P 161	.004	P 1201	.0032	Compressor A. C.	.021	18	
P 162	.0084	P 1283	.0029	Compressor D. C.	.027	9	
P 163	.008	P 1284	.0107	Rotary Converter	.022	8	
P 165	.0048	P 1349	.0039	Spray Warmer	.01	2	
P 167	.006	P 1404	.0028	Unit Mod "B", A. C.	.3112	265	
P 168	.0045	P 1405	.0047	Unit Mod "B", D. C.	.3112	110	
P 340	.0177	P 1547	.003	Dist Panel Mod "B"	.1697	0	
P 360	.0011	P 1673	.0023	X-Ray	.122	165	
P 385	.0016	P 1815	.0023	Chair			
P 390	.0009	P 1866	.00067				
P 391	.0009	P 2840	.00058				
P 401	.0016			Total		1206 lbs.	
P 402	.0025			Minimum Quantity		800 "	
				Quantity to Order		800 "	

FIG. 5 ROUGH STORES RECORD

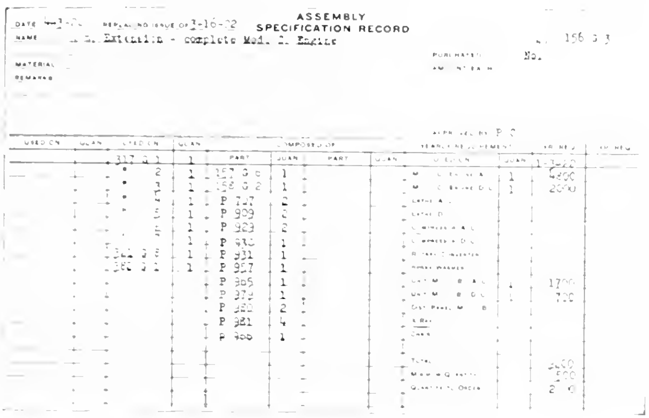


FIG. 6 ASSEMBLY SPECIFICATION RECORD

must have complete, detailed, and up-to-date records of all assemblies. A plant, if it is at all progressive, is not standing still in the way of design, and is constantly making changes in its product. After going to the expense of building up the various material specifications to facilitate handling of the product through the shop, it is obviously necessary to the efficiency of the planning department that all changes in the product, which affect the material specifications, be reported to it or to such other department as may be maintaining the master records. Unless this is done and done promptly and the changes correctly tabulated on the records, it will only be a question of a short time until these records become inaccurate, and thereby cause a great deal of confusion in the planning department and in the factory itself.

As illustrated, it requires 0.17 lb. for a Model "C" Engine, A. C., and 0.132 lb. for a Model "C" Engine, E. C., etc. As with the piece part specification, the amount of stock used on each article of equipment, extended by the yearly production schedule of this equipment, gives the total number of pounds of stock used for a year's production on each article, and when totaled, gives the entire amount of stock required to produce the complete schedule for a period of one year.

On the reverse side of the specification form, there is incorporated a change record which is shown under Fig. 7. All changes made in the product are reported on this form to the department maintaining the master records and this department in turn makes the changes in the various departmental records. This keeps the specifications accurate and is of the utmost value.

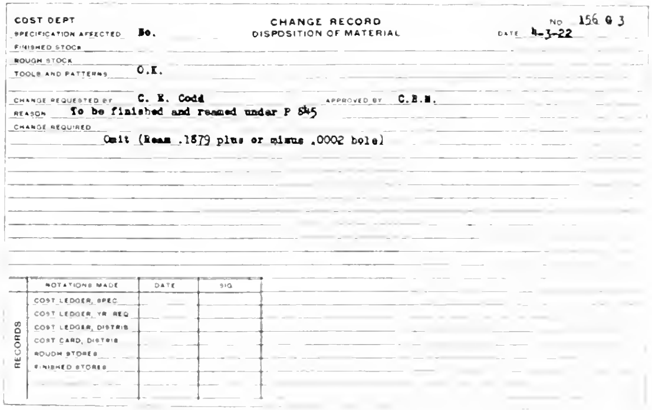


FIG. 7 CHANGE RECORD SHOWING DISPOSITION OF MATERIAL

This is very valuable from the standpoint of placing purchase requisitions, as it gives the planning department a basis to work on. And as has been said before, this enables the planning department to maintain a control of inventories and to keep a balanced condition in their stores. An unbalanced condition, particularly in rough stores, will result in hold-ups in production which are not only costly, but which may be the means of losing orders.

The next record, the assembly record, is of the utmost importance. An illustration of this is given under Fig. 6. It is the same in form as the piece part specification record already shown.

In operating an assembly department the requirements of each assembly must, of course, be known in order to requisition parts from stores, and this information should be a matter of record as no one can be expected to remember all the parts contained in the various assemblies and the quantity of each part used in each particular assembly. In practice, if this assembly work is allowed to go through on somebody's guesswork, there is bound to be much confusion and much time lost in looking for parts.

Such a record is equally important in the planning department. It is almost impossible to manufacture a complicated product without the aid of a planning department, and to function properly that department

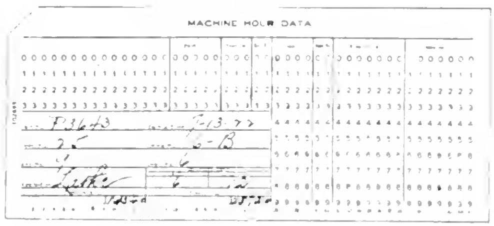


FIG. 8 TABULATING CARD SHOWING THE ROUTING OF OPERATIONS

Ritter Dental Manufacturing Co., Inc.
SUMMARY OF MACHINE HOURS

DEPT NAME Punch Press — DEPT. NO. 2
GROUP NAME #4 Baxendale Press — NO OF MACH. 8-9-1-23 6 — MACH. GROUP 2 - A

	DATE February 1, 1921.			DATE May 24, 1922			DATE August 1, 1923.		
	MACH HRS PER UNIT	YEARLY SCHEDULE	MACH HRS REQUIRED	MACH HRS. PER UNIT	YEARLY SCHEDULE	MACH. HRS. REQUIRED	MACH. HRS PER UNIT	YEARLY SCHEDULE	MACH. HRS. REQUIRED
MOD "C" ENGINE A C	.5664	1800	1019.5	.4991	1800	898.0	.4638	2400	1113.0
MOD "C" ENGINE, D C	.4437	900	399.0	.5593	900	503.5	.4445	1200	533.5
LATHE, A C	.6334	1800	1140.0	.5462	1800	983.0	.5094	2400	1222.5
LATHE, D C	.2385	900	214.5	.2314	900	208.0	.2355	1200	282.5
COMPRESSOR, A C	.0983	1350	132.5	.1995	1350	269.5	.2316	2400	556.0
COMPRESSOR, D C	.1785	900	160.5	.2778	900	250.0	.2955	1200	354.5
MODEL "B" PANEL	1.0302	900	929.0	0	0	0	0	0	0
ROTARY CONVERTOR	.2210	900	199.0	.2426	900	218.5	.2300	1200	276.0
UNIT, A. C	1.8533	1350	2502.0	1.6506	1350	2228.5	2.4254	1350	3274.0
UNIT, D. C.	1.5992	450	720.0	1.4899	450	670.5	2.4055	450	1082.5
SPRAY WARMER	.0511	450	23.0	.0511	450	23.0	.0511	450	23.0
X RAY	0	0	0	1.0012	1800	1802.0	.4535	1800	816.5
CHAIR	.0402	3600	151.0	.0469	3600	169.0	.6646	3600	2392.5
Tri-Dent	0	0	0	0	0	0	.6531	3600	2351.0
STANDARD HOURS			7,590.0			8,823.5			14277.5
HOURS AVAILABLE			14,400.0			14,400.0			19200.0
DEFICIT OR SURPLUS		Sur.	6,810.0		Sur.	6,176.5		Sur.	4922.5

FIG. 9 SUMMARY OF MACHINE HOURS REQUIRED TO PRODUCE ONE ARTICLE

One of the first things for a planning department to do is to arrive at the plant capacity or the machine capacity or, in other words, "find the neck of the bottle." In most plants the capacity of the plant is determined by the department having the smallest production capacity. It is practically impossible to arrange a plant in such a way that all departments are of equal capacity, and there is always some department whose capacity determines the factory output regardless of how much production the other departments may turn out.

Planning is a matter of scheduling parts through the plant so that they will be finished at the time they are required for assembling. Necessarily some parts take longer to machine than others and should be started before those requiring a shorter time to complete, but the question is: How much sooner? This is governed to a great extent by machine capacity.

To determine this, as a first step, a complete inventory should be taken of all machinery in each department and an adequate description of each machine incorporated in the inventory. The next step is to classify each department's machinery in such a way that machines of a similar nature will be grouped together and given a group number. For instance, all No. 4 W. & S. hand screw machines are given a group number; similarly 10 in. lathes are given a number, etc., so that when a number is referred to, such as 4 — B, it will mean all the No. 00 B. & S. automatic screw machines in department No. 4.

On the routing card is noted the machine group upon which each operation on each part is performed. A tabulating card as illustrated in Fig. 8 is made out for each operation contained in the routing book regardless of whether it is a machine or hand operation. This is a big undertaking but when completed a foundation has been laid which will permit a number of records of extreme value.

Ritter Dental Manufacturing Co., Inc.
SUMMARY OF MACHINE HOURS

DEPT. NAME Punch Press — DEPT. NO. 2
GROUP NAME Complete Department — NO OF MACH — MACH. GROUP

	DATE February 1, 1921.			DATE May 24, 1922.			DATE August 1, 1923.		
	MACH HRS PER UNIT	YEARLY SCHEDULE	MACH HRS REQUIRED	MACH HRS. PER UNIT	YEARLY SCHEDULE	MACH HRS REQUIRED	MACH HRS PER UNIT	YEARLY SCHEDULE	MACH. HRS. REQUIRED
MOD. "C" ENGINE, A.C	1.9661	1800	3539.0	1.7140	1800	3085.0	1.5552	2400	3732.5
MOD "C" ENGINE, D C	1.7732	900	1596.0	1.8738	900	1686.5	1.5724	1200	1887.0
LATHE, A C	.7475	1800	1345.5	.6149	1800	1106.5	.7006	2400	1681.5
LATHE, D C	.5019	900	502.0	.4790	900	431.0	.4815	1200	578.0
COMPRESSOR, A. C.	.2559	1350	345.5	.3199	1350	432.0	.2765	2400	663.5
COMPRESSOR, D. C.	.8036	900	723.0	.8478	900	763.0	.5499	1200	659.5
MODEL "B" PANEL	1.7485	900	1573.5	0	0	0	0	0	0
ROTARY CONVERTOR	.4588	900	413.0	.4844	900	436.0	.4693	1200	563.0
UNIT, A. C.	3.2348	1350	4367.0	3.1582	1350	4263.5	4.0535	1350	5472.0
UNIT, D. C.	2.9118	450	1310.5	2.8794	450	1295.5	3.9263	450	1767.0
SPRAY WARMER	.1023	450	46.0	.1023	450	46.0	.1023	450	46.0
X-RAY	0	0	0	1.8702	1800	3366.5	1.2757	1800	2296.0
CHAIR	.4075	3600	1467.0	.3747	3600	1349.0	.9198	3600	3311.0
Tri-Dent	0	0	0	0	0	0	1.7748	3600	6389.0
STANDARD HOURS			17228.0			18260.5			29046.0
Std. No. Men Req'd			7.1			7.6			12.1
DEFICIT OR SURPLUS	Add 40%		10.0			11.0			17.0

FIG. 10 DEPARTMENTAL RECAPITULATION OF MACHINE HOURS

To get the departmental capacity these tabulating cards are first sorted by department number which segregates all the work performed by any one department. The next step is to sort each department by machine group which segregates all work done on a given machine or machine group. Each machine group is then sorted by key number which, in other words, is by article of product. By adding these cards the total time required to produce one article on each group of machines is obtained.

The form shown under Fig. 9 is then made out for each machine group in each department and the time required for the different articles of equipment is listed under the heading "Machine Hours Per Unit," this information having been secured from the above summary.

The next thing to determine is the yearly schedule under which the plant expects to operate. This information is usually available inasmuch as nearly every manufacturer producing a standard article determines for a year in advance what his production is to be based upon.

This information is accordingly placed under the column "Yearly Schedule." The number of machine hours required to produce the schedule of each article is readily determined by multiplication. These requirements are then totaled, which give the standard hours necessary to produce the complete schedule on the particular group in question. Considering that there are 2400 working hours in a year and that there are six machines in this group it would be apparent that the available hours in the group are 14,400.

In the illustration the standard punch press hours required to manufacture the schedule of the first columns are 7590, while the capacity is 14,400, giving a surplus of 6810. This is not any too much when it is considered that punch presses are tied up a great deal on account of set up, tool and machine repair, absent operators, etc. This is borne out by the fact that it was necessary to increase the number of machines when production schedules were increased.

Departmental Recapitulation of Machine Hours

The individual groups of machines are then summarized into a departmental recapitulation as is shown in Fig. 10, which shows the time required in the department to produce each article of equipment. This when totaled shows the number of standard hours required within the department to complete the schedule. Dividing this total by 2400, the number of working hours in the year, gives the standard number of men required in the department. After determining the amount of lost time in the department due to set-up, tool and machine repair, etc., the correct number of men required by the department can be furnished. With the number of men figured out in this way a foreman cannot load his department with excess help but must produce his schedule with the number of men furnished him or show why he cannot do it.

These records also show if there is any excess machinery or whether there is a shortage, and if there is a shortage the record shows exactly where it is and the situation can be remedied before any serious stock

ROUTING TAG

Part No. 6630 Order No. 1356

Quantity of Order 600

Date to be Del. to Stock 10-23-23

285700

Oper. No.	Mach. or Group	Starting Date	Finishing Date	Qty. Fin.	Date Fin.	INSPECTION Pieces O. K.	Pieces Def.	Pieces Scrapped	Inspector
3	3406	9-27	9-27	600	9-27	600	✓	✓	JK
5	3460	9-28	9-28	600	9-28	600	✓	✓	JK
11	916	10-2	10-2	596	10-2	596	✓	4	SJ
17	3405	10-5	10-5	596	10-5	596	✓	✓	JK
20	HD	10-11	10-16	591	10-16	691	✓	5	JK
Insp.	—	10-18	10-18	591	10-18	✓	✓	✓	HS
25	HD	10-20	10-22	587	10-22	587	✓	4	MD

FIG. 11 ROUTING TAG SHOWING WORK COMPLETED

shortage results. This is obviously one way of "finding the neck of the bottle," because any shortage in equipment in any department will show itself, and by applying the schedule to the various departments and machine groups in the manner outlined it is easily determined which department has the least excess capacity. Knowing this, then, it is easily determined how much the schedule can be increased and still have it pass through.

Another interesting record which can easily be compiled from this data is to take the machine hours required to produce each piece of equipment in each department and extend them by the average hourly wage rate prevailing on the individual group or the department as a whole. By summarizing all departments the total standard hours required for the manufacture of each article of equipment together with the standard cost of the article can be obtained.

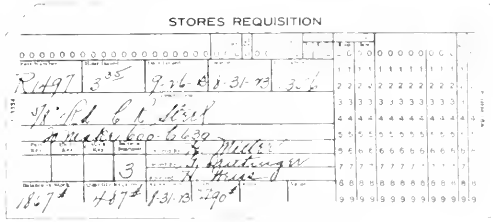


FIG. 12 STORES REQUISITION

Those not employing the standard cost method can draw some very profitable comparisons between the actual costs as compiled by their cost accountants and the standard costs as determined by the machine hour record. If this is done it is probable that they will become so interested in checking up the actual detail cost with the standard detail cost that they will finally adopt the standard cost method.

To operate any planning system, or for that matter in order to produce at all, it is necessary to have stock control in the shape of a perpetual inventory. Every accountant is familiar with the operation of inventory systems and they will not be discussed in these articles —at least from a planning standpoint. Suffice it to say that it is necessary to have an adequate control of stock and that such minimums and order quantities be established as are required by the conditions existing in the particular plant.

Inasmuch as it is not intended to discuss planning from the standpoint of laying out a complete planning system, but rather from the standpoint of how it affects cost control, only such phases of planning will be discussed as will serve to show that planning is a distinct aid to the cost system.

It is the duty of the planning department to issue production orders to the factory and see that they are carried through to completion. Probably this assigning of work to the different machines and production centers is one of the most important duties of the department.

The actual work of assigning is done from a central control station which may serve one or more departments depending on the size of the plant and departments. These assignments are made from a routing card sent out from the planning department with the production order. Fig. 11 shows this card as it appears when the work has been completed. When sent to the control station by the planning department it has only the first four columns filled out. These show the operation number, the machine the work is to be fashioned on, the date the operation is to be started, and the date the operation is to be completed.

Attached to the routing tag and production order when it is sent out from the planning department is the stores requisition shown in Fig. 12 which is filled out completely so the control station can secure the correct material.

At the time the first operation is scheduled to be started, the control station draws the material from

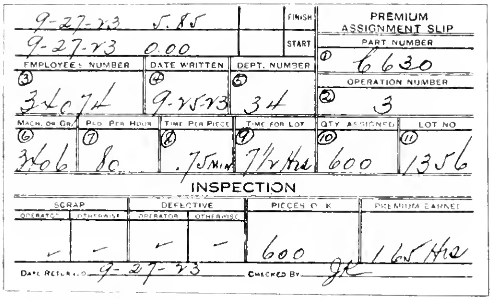


FIG. 13 ASSIGNMENT SLIP

stores and makes out the assignment slip shown in Fig. 13. When the stock is sent to the department it is accompanied by the routing tag and the assignment slip. The assignment slip when sent out has only those spaces filled in which are indicated by the circled figures. The others are filled in as the work progresses.

When the foreman of the department in which the work is to be done is ready to start the job, he gives the assignment slip to the operator indicated and sends him to the time clerk. The time clerk punches the starting time on the assignment slip and on a blank time ticket. This time ticket is shown in Fig. 14. This is a Hollerith tabulating card which later is used by the pay-roll and cost departments as original data. The timekeeper then fills out the time ticket with the information contained on the assignment slip at that time and the operator goes back to his work.

After the operator has completed the work he returns to the timekeeper bringing the assignment slip together with the assignment slip for the new job. The old slip and its supporting time ticket are punched out and the new ones punched in. The two assignment slips (finished and unfinished) are returned to the operator, who goes back to his department. Upon arrival there the old assignment slip is placed on the completed work and it is then ready to be taken into the inspection department for inspection and count.

After inspection and counting, the count is placed on the assignment slip and routing card and the work, together with both the routing card and assignment slip, is sent to the control station where it is stored until such time as it is scheduled for the next operation.

The routing card is left on the work but the assignment slip is checked up and a copy of it sent to the planning department to serve as a link in the follow-up system. The original, now complete, is returned to the timekeeper who takes the time ticket from the file and inserts the count. At that time he computes the premium hours earned or lost and inserts this on both the time ticket and assignment slip. He then returns the assignment slip to the operator who keeps it as a receipt against his pay. The time ticket is then forwarded to the pay-roll department where the earnings are computed and the ticket held as a means of building up the weekly pay-roll.

Planning as Related to Cost Accounting

It is to be emphasized that none of the records and procedure of the planning department have been designed or undertaken to enable the cost department to obtain cost, and the expense of installing and maintaining the system as outlined so far is not in any way chargeable to the cost department.

All these things—routing, time study, material specifications, machine hour or plant capacity records—have been undertaken to increase individual production on the part of the operator and to serve as a control of production and stock These are heavy dividend payers in any plant and are absolutely necessary if the

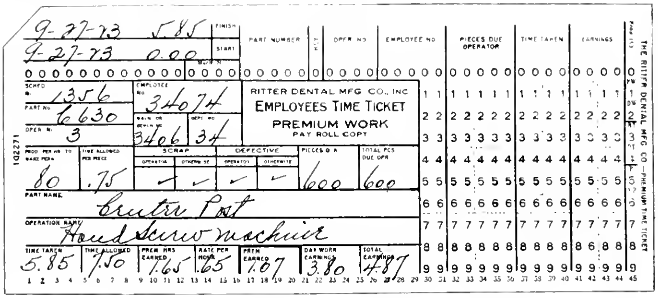


FIG. 14 HOLLERITH TABULATING CARD USED AS A TIME TICKET

plant is to keep in the running against competition.

All the records described must be maintained with the utmost accuracy for errors may prove very costly to production, but when they are accurate they provide a wonderful foundation for the ideal cost system. With them at hand everything which the cost accountant has dreamed of for years is his to work with, and no one can say that the cost system is an expensive thing because of them. The cost system is then simply a by-product of the factory system. Not only has the cost accountant a good foundation but he knows it is accurate and that the accuracy of the records is the responsibility of the very people who have always given the cost department the most difficulty in securing costs. It is the factory system not the cost system, and no longer can the factory say to the cost accountant that his costs are all wrong and do not mean anything. By such a statement the factory man would lay himself open to criticism of his own methods, for he makes the cost, and the cost department is simply an agency for recording the results of his work. From these conditions results the complete unified system with the factory as well as the office responsible.

A Cost Comparison in Handling Materials

Mechanical Equipment Contrasted With Hand Labor at the Warren Foundry and Pipe Company

By SHELLMAN B. BROWN

Superintendent, Warren Foundry and Pipe Company

Class Number
658.9:621.72 Foundry management
658.281 Handling material

IN extensive foundry operations the control and handling of materials is a very large factor of the cost. This is particularly true where the products are large in size and weight and where only a portion are machined, the rest being shipped and used as cast.

The Warren Foundry and Pipe Company, of Phillipsburg, New Jersey, manufacturers of cast-iron pressure pipe and fittings for gas and water service, paper mill and chemical castings, heavy machine parts, and the like, and employing 650 men, presents a typical case of the above nature. In addition, the plant, started in 1856 in a few buildings, and now occupying an area of 1/8 x 3/8 miles on which are 7 foundry units, illustrates well the history of many industrial enterprises which have grown from small beginnings gradually to large proportions. Besides this, the foundry owns and works several sand and clay pits at nearby points.

The following figures will indicate the quantities of material handled during the year 1922, practically all delivered in cars from two railroads adjacent to the plant:

Material	*Net Tons*
Pig and scrap iron	78,000
Clay	11,000
Sand	10,950
Coke, for cupolas	10,800
Coke, for fuel	800
Coal, anthracite	10,800
Coal, bituminous	4,000
Limestone	2,100
Hay and straw, for corebars	950
Paper, for corebars	200
Sea coal, for mold coating	75
Core compound	70
Tar for coating pipe	14,000 gallons
Wood for lighting cupolas	500 cords

Foundry operations are carried on at the same rate all the year round. During the months from March to November, pipe moves out of the yard as rapidly as produced. Contracts for pipe and fittings placed during the fall and winter are in part for spring and summer delivery, when weather conditions are favorable for pipe laying. Capacity not thus engaged is used to stock up on common sizes for spring shipments. Hence vast quantities of raw material must be available during the winter when transportation difficulties are at their worst. Moreover, the annual threat of coal strikes makes necessary the storing not only of fuel but also of other materials which the railroads would not be able to move if shipping were curtailed on account of coal storage. It is therefore necessary for us to have on hand between three and six months' supply of materials in order to avoid shutdowns. The problem of bringing in, storing, and moving these large quantities economically to the place of use, without crowding out roadways to buildings and storage space for pipe and the numerous large pieces of equipment used in pipe making, is one that requires careful planning.

FIG. 1 CLAY SHED SHOWING SCRAPER CONVEYER

Pig iron and one-man pieces of scrap are unloaded so far as possible in back of the various foundries. Large scrap, such as chemical, paper mill, and locomotive castings, is unloaded in the lower yard where it can be broken up by a "skull cracker" dropped from the boom of a locomotive crane. Carloads of iron

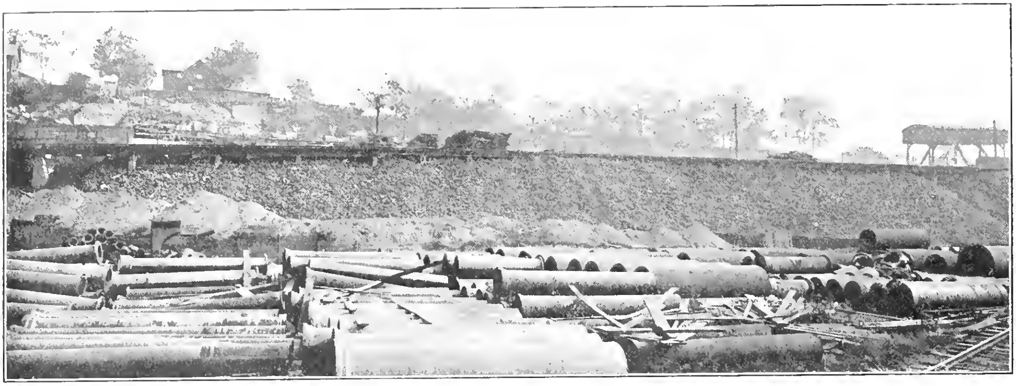


FIG. 2 TRESTLE 700 FT. LONG FOR THE STORAGE OF COAL AND COKE

average around 40 tons in weight and are emptied by means of lifting magnets where possible. At four of the foundries overhead traveling cranes in the rear of the buildings do the unloading, using a magnet. One man, the crane runner, does the work, as he has ample height below the crane runway in which to pile the iron. It takes him about an hour, on the average, to unload a 40-ton car.

The other three foundries are older buildings and have not been equipped with outside cranes. Here the unloading of iron is done by locomotive cranes or by hand labor. The locomotive crane or "modoc" uses a lifting magnet and empties a 40-ton car in one hour; but three men—engineer, fireman, and laborer—are required. Hand labor is usually done on a contract basis with the workmen—30 tons of pig or plain scrap, and 25 tons of scrap in awkward shapes such as locomotive grate bars, radiators, etc., being considered a 10 hr. day's work for one laborer.

The relative costs of unloading after the cars are spotted, and taking into account interest on investment, depreciation, repairs, overhead, power or fuel, and labor are as follows:

METHOD	APPROX. COST PER HOUR	APPROX. COST PER TON
Electric crane and magnet	\$2.40	\$0.06
Locomotive crane and magnet	3.20	0.08
Hand labor (one man contract)	0.75	0.25

Sand and clay handling are practically similar, and identical rates prevail for the two. Molding sand and clay are unloaded usually at the front of the foundries and rarely underneath any traveling crane. Hence the cost comparison lies between handling by bucket and locomotive crane, and by hand labor. Again a 40-ton car is the basis of costs. The locomotive crane with bucket attachment can do the work in one hour, while about 13 man-hr. are required when hand-shoveling is used. The relative costs including the elements as in iron handling, plus bucket charge are:

METHOD	APPROX. COST PER HOUR	APPROX. COST PER TON
Locomotive crane and bucket	\$3.20	\$0.08
Hand-shoveling (one-man)	0.45	0.15
Hand-shoveling (high piles)	0.60	0.20

Sand and clay for cores, in all foundries but the one making green sand castings, are unloaded into so-called "clay-sheds." Formerly this was a shoveling job either from railroad cars or from piles dumped on the ground by carts. Now, however, it is almost entirely a locomotive crane and bucket proposition. The crane brings a car to the point of unloading, and then lifts from the clay shed removable portions of the roof over the bins to be filled. The bucket drops the sand into the shed through these openings. An interior view of one of these clay sheds is shown in Fig. 1. The bins are to the right and left, constructed back of the heavy square posts appearing in the picture. The cars of material are brought up on tracks back of the doorway, shown at the center.

The Hand Labor Method of Unloading Sand

About 40 tons per hr. can be unloaded by this method. When shoveling was done from a car, four men were required on the car, and a platform had to be built in front of the shed on which the sand was thrown. On this platform four additional men were stationed to shovel the sand into the bins, and if high piling was necessary, still a third group of four was placed inside the building. For bins in the rear of the shed the method of filling was by wheelbarrow transportation. It took about 3½ hr. to unload a 40-ton car. The comparative costs of this method and crane and bucket unloading are:

METHOD	APPROX. COST PER HOUR	APPROX. COST PER TON
Locomotive crane and bucket	$3.20	$0.08
Hand-shoveling, 8 men	3.60	0.29
Hand-shoveling, 12 men	5.40	0.44

Three advantages must be credited to the electric or locomotive crane methods of handling over manual labor. The number of men who can work in one car without interference is limited to four. Hence a car would be tied up about $3\frac{1}{2}$ hr. under shoveling operations. When so many cars of material come in during a week, sometimes several at once, it is important that they be unloaded without delay, to eliminate congestion and return the cars to the railroad promptly. Moreover, yard traffic is seriously tied up if cars are held long at unloading points along the main tracks and roadways. Finally, in a yard where large storage areas are required for stocks of pipe and stocks of material, high piling is an economy of space, and an economy of transportation in locating the greatest possible bulks of materials at the point of actual use, or where they can be reclaimed with the least expense.

FIG. 3 NO. 4 FOUNDRY WHERE HAND LABOR IS LARGELY EMPLOYED BECAUSE NO OUTSIDE CRANE IS INSTALLED AT THIS POINT

Coke used for cupola fuel, broken and bituminous coal used in the mold and core ovens and on the 3 locomotives and 4 locomotive cranes, and the smaller sizes of anthracite used for power generation are not materials of manufacture, but they are vital to plant operation and are purchased in such bulk that the handling is a real problem. Practically all of these fuels arrive in hopper bottom cars. When unloaded at the point of use they are handled in one of several ways: By locomotive crane and bucket; by dumping on the ground and shoveling away, sometimes with a portable conveyor; and by dumping into pockets, where mold and core oven fire-boxes are adjacent and below the level of the ground and the cars can be run over a trestle spanning [illegible]

The larg[illegible] reserve [illegible] the point of use, how[illegible] Hence in 1921 a tres[illegible] hillside and bottom dump [illegible] coke and [illegible] emptied there. This trestle is shown in Fig. 2. Some minor labor is required to clean out the cars completely and adjust the masses of fuel, but the operations are very irregular and segregated costs have not been kept. The slope of the hill and its length and height are such that about 80,000 cu. ft. of fuel can be stored below the trestle without any great amount of hand labor. Access to this material is obtained by means of a track on a lower level, and a locomotive crane and bucket are used in the reclaiming process.

Limestone is used in much smaller quantities than other materials and is either dumped or shoveled from the cars at points in back of the various foundries, underneath crane runways in most instances. A small amount of hand labor is involved but not enough to justify careful segregation in cost keeping.

Hay and straw are used, and in some cases heavy corrugated paper, to cover corebars for pipe and certain fittings, before the loam or mud is put on and baked. The purpose is to provide a combustible material which will burn off when the casting is poured, allowing clearance for the extraction of the corebar. These materials are unloaded on a siding from the main line of one of the railroads running by the plant, the tracks being at an elevation 28 ft. above the plant yard level. Three large adjacent buildings on the hillside are used to store the materials, and they are taken out on the opposite side at the lower level and carried about 50 ft. over to the building where they are wound into rope. Hay and straw purchased from local farmers comes in at the yard level and is hoisted to the second floor of the rope winding building where it is stored until needed downstairs. Paper used to be stored here also by rolling it from a car on a nearby track and hoisting it to the upper floor. It was cut for use, as required, on a special machine downstairs. Growth of the business necessitated using all of the space for straw rope, however, so the paper is now unloaded and cut under identical conditions in a building further up the yard.

Sea coal and core compound are stored in sheds toward the center of the plant, and are protected from the weather. They are unloaded by hand from cars run alongside of these sheds. As the receipt of these materials is infrequent and the quantity small, no separate records are kept of the time taken by the general labor gang to unload them.

Tar combined with a little dead oil is used for coating the pipes and fittings. The castings are heated and dipped into the large tanks containing the coating mixture and located below floor level. The tar is received in barrels. Shipments are largely timed to meet tank filling requirements and are unloaded at point of use by locomotive crane. This saves extra handling. A reserve supply is stored in one of the old buildings no longer in use as a foundry, and is taken off the car by locomotive crane and rolled inside a short distance by hand labor. Here, again, no accurate record is kept of actual time and cost involved, the operations being infrequent and taking only perhaps and hour or two each time.

Wood is unloaded from cars and piled by hand labor. The main object in view is to get the cars out of the way promptly. Piling is done at odd times when other work is not pressing, and detailed costs are not kept.

Up to this point we have discussed merely unloading methods. Many of these are far from what we would call ideal, but they are actual operations and as such are presented here. By degrees, also, our cost keeping is being itemized so that actual expense details of many operations now lumped together will be matters of accurate separate records. It is evident that materials handling equipment is cheaper than hand labor, but its introduction requires time and careful study. However, it has to come, for labor is scarcer and less willing than ever before. It takes three men today to do work formerly done by two. As men are not always available machinery becomes not only a matter of economy but of absolute necessity.

In moving materials from the point of unloading to the point of use, we have two kinds of operations—one, from yard storage or shed to foundry, and the other from point of delivery at the foundry to the actual job.

Unloading Pig and Scrap Iron

Pig iron and small scrap are almost never unloaded anywhere but back of the foundries. Large scrap is kept out in the main storage areas principally because it can more safely and conveniently be broken up at this point. After breaking, it is loaded on cars and unloaded at point of use by a locomotive crane and a lifting magnet.

Bulk materials, such as coal, coke, sand and clay are moved from reserve storage to the foundries usually by loading on a car and off again at point of delivery, using a locomotive crane and bucket. Occasionally hand shoveling on cars or on one of the four Acme trucks is employed, the trucks having the advantage of quick operation and dumping. However, hand labor is expensive and is avoided wherever possible.

Hay and straw rope, and paper cut to size, all used in making cores, are moved from point of preparation into the various foundries by Clark trucktractors, which can make the short turns and get through narrow doorways. Sea coal and core compound are likewise transported by this means. Scrap hay and straw are bundled and carried to the foundries by truck or on one of the trips of the locomotive up and down the yard. They are used to light the cupolas, in connection with wood and coke.

Limestone, wood and tar are practically always stored at points of use and require no rehandling.

The final phase of handling involves getting the materials from the immediate vicinity of the foundry to the actual job. The worst condition with which we have to deal is at our old No. 2 and our No. 4, or 60 in., pipe foundries. These are old buildings so located that we have not found it expedient as yet to put outside crane runways behind them. In fact one of them will eventually be torn down and replaced.

At rear of No. 4 foundry, shown in Fig. 3, iron, scrap, coke, wood, limestone, etc., are unloaded by magnet, by hand, or by shoveling, as the case may be, on the level of the upper platform, which leads in to the cupola charging floor. From this point they have to be loaded by hand on trucks or wheelbarrows and taken in to the cupola. Molding sand and clay are delivered at the front of the building and are taken in as needed, the sand by a chute to the basement, and the clay by wheelbarrow. Core sand and clay are moved from the clay shed to the platform over the mud or mixing mills by shoveling each kind of material as required into the trough of a scraper conveyor (see Fig. 1) which carries it along the floor and up an incline into the main building. Here it is shoveled directly off into the mills. From the mills it drops into mud buggies which are wheeled over to the core mak-

FIG. 4 FOUNDRY USING CRANE TO HANDLE MATERIALS

ing machines. The labor involved in these operations is one of preparation rather than of handling, except for the cupola.

The enclosed bucket elevator shown in Fig. 3 discharging down a chute into the window was installed to simplify one problem in handling materials. When the work of casting has been completed each day, the bottom of the cupola is dropped. The material is pulled outside by use of a motor and cable, with scraper attached, and when it cools off is cleaned by tumbling in a revolving drum, shown at the base of the elevator. Dirt drops out and the tumbler retains only the larger particles of iron and coke, both valuable. These are dumped, and previously were loaded on a cart which emptied them near a track. They were then shoveled on a railroad car, moved down the yard and up the grade to the level of the charging floor, about 20 ft. higher, and here thrown off outside to be carried in and charged back into the same cupola. The bucket elevator now raises this material in one shoveling operation and dumps it directly alongside of the cupola. This change is typical of the many improvements that can be made in handling materials in almost any plant.

As a contrast to the method of handling the materials for the cupola above described we find shown in Fig. 4 a rear view of New No. 2 foundry, the most recently constructed of our pipe foundries. Here most of the car unloading is done by means of the overhead crane. Also most of the materials are taken from the storage piles shown in the picture to the charging platform back of the cupola by means of this crane. The illustration shows the crane lifting a skip of pig iron, which will be placed directly on a truck running on a track on the charging platform. It will then be moved directly to the cupola door where the iron will be thrown in. Coke is handled in exactly the same manner except that instead of being dumped directly into the cupola it is emptied alongside and thrown in by the shovelful as needed. Limestone is treated the same way as coke, and wood and straw are also thrown in from the top but only when starting up the cupola very early in the morning.

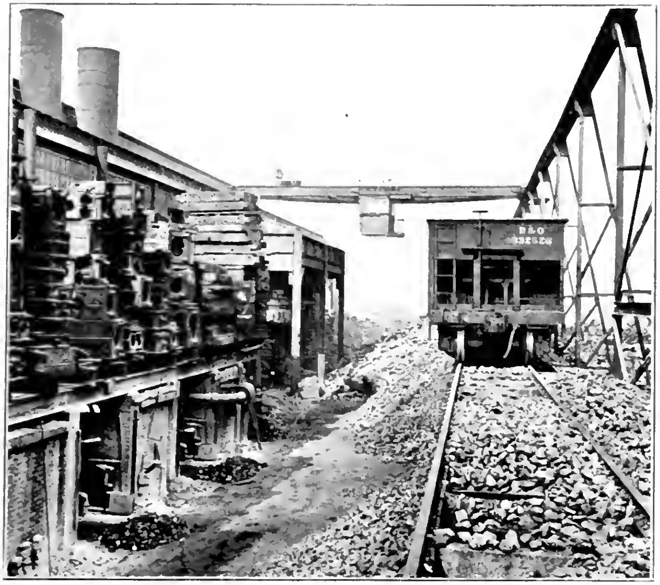


FIG. 5 TRESTLE AND OVERHEAD CRANE USED IN MATERIALS HANDLING

In the foreground of the picture may be seen one of the depressed pockets beneath the railroad tracks into which is dumped coal for the mold and core ovens. The oven fire-boxes are at the back of the building.

Sand and clay both for molds and for cores are taken in at the front of the building in much the same manner as already described for No. 4 foundry. For both foundries, hay, [illegible] straw, rope, paper, sea coal, [illegible] compound and similar materials are taken inside and carried to the point of use by wheelbarrow.

Molding sand is reused in the following manner. After a flask is poured and the pipe has partially cooled, the flask is lifted by inside traveling crane to a skid where the clamps are knocked off, the flask is dumped and the red hot pipe is allowed to roll outside the building. The sand falls on a grid through which it drops to a hopper leading it to a drag conveyor. This conveyor scrapes it through a trough in the basement of the building to a point where it falls on a belt. Here it is elevated and travels over a magnetic pulley which separates the particles of iron and any wedges which have fallen through from the flask. Then the sand falls on another conveyor which dumps it in a pile where clay wash is mixed with it. A man then scrapes it by a hoe directly into the hopper of a bucket elevator. The elevator takes it up to the third floor where a chute runs it out immediately over the ramming platform. Here it is shoveled down through circular chutes directly into a flask again. Then the flasks are taken to the mold oven, baked, poured, and dumped, and the sand goes through the same process again.

Thus it is seen that materials forming the mold are used over and over again, and materials handling is a repetitive operation. Make-up sand to replenish losses is introduced in the basement of the building where the clay-wash mix is added.

Core sand likewise goes through a cycle of handling. After the pipes are rolled outside the building, the cores are cleaned out by a special cutter and by hand scraping. The material, which is baked clay and sand, falls underneath the skids and is later shoveled or handled by portable conveyor into trucks which take it down and dump it into a hopper at a sand reclaimer building. Here it is elevated upstairs to the third floor, is broken up, has the iron separated by magnetic pulley, and is segregated into classes—lumps, coarse sand, fine sand and dust—by an air process. It then falls into separate bins forming the second story of the building, and underneath these bins the trucks back in and receive loads of the various materials. The lumps and the fine dust are taken to city dumping pits. The iron is taken back to various cupolas. The good sand reclaimed is moved to the foundries as needed and forms part of the make-up sand for core making.

A third variation in the handling of material is shown in Fig. 5, a view back of No. 1, or the green sand foundry. Here we have not only an outside crane runway beneath which materials are unloaded but also a trestle 300 ft. long and elevated about 12 ft. above the ground, so that bottom-dump cars can be emptied with little if any hand labor. The crane then lifts these materials to the charging floor in a manner similar to that described for New No. 2 foundry. As the core ovens at this point are above ground, coal is dumped under the trestle within a few feet of the fire-boxes where it will be needed.

In all of the foundries, when pouring is over for the day, the iron left in the cupola is drained out, so far as possible, and allowed to harden and cool in sand troughs hollowed out in the floor below the tapping spouts. This iron, together with that from the gates, risers and runners knocked off of the castings, is loaded by hand on skips (sheet iron boxes) and run under a traveling crane which lifts it to the charging floor for use over again. Refuse—dirt, burnt paper and rope, slag, and other waste material—is loaded on cars by direct shoveling, or by filling skips which the crane lifts and dumps, and is then transferred to trucks and taken to one of the city dumping pits. The railroads no longer accept this material for their land filling operations.

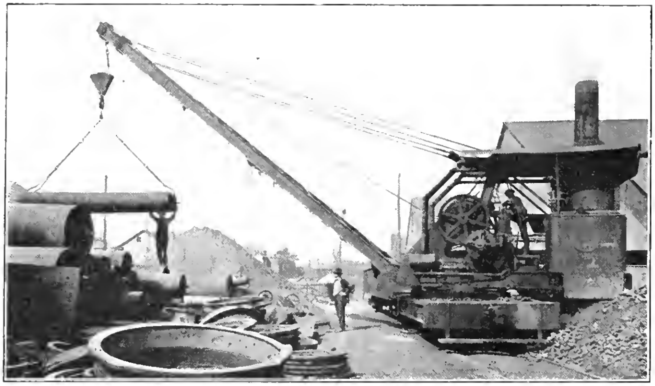


FIG. 6 LOCOMOTIVE CRANE MOVING PIPE-MAKING EQUIPMENT

The only major point not covered thus far in the discussion is the delivery of loam or mud for coating corebars. It was stated that loam buggies were used at No. 4 shop but the haul is too far in certain other places. It happens that our foundries group in twos, and that in each case one set of mud mills serves the two buildings, but is located somewhat distant from one of the two. To get the loam to this second point of use a traveling hoist is used. In one case this is floor operated and in another case a Shepard monorail hoist, with operator's cage, is employed. Loam is dumped from the mills into large bottom-dump tanks, which are hoisted and emptied into storage bins convenient to the core machines. Under these bins the mud buggies are run and filled by opening a lever valve. Then the buggies are taken over to the points where the cores are made.

As pipe is made in standard 12 ft. lengths, except on special order, and many fittings, cylinders for paper machines, and other castings, are likewise large, the weight of castings may sometimes run as high as 10 tons. This means that flasks, corebars, plates and other equipment are very heavy and bulky. Inside of the foundries electric cranes do the handling, but we could not keep any appreciable portion of the equipment for our many kinds and sizes of product in the foundry buildings, because all the space is needed for production. Hence we are faced with the necessity of moving it in and out of the buildings on railroad trucks as we need it, and carrying it to and from storage points, some of them necessarily at quite distant parts of the yard. The work is done by locomotive cranes and railroad cars. This occupation, in addition to loading pipe for transfer or shipment, and handling the thousands of tons of material annually as described above, keeps the cranes constantly busy. Fig. 6 shows one of the Industrial Works cranes loading corebars.

Since we depend so much upon these cranes, a few figures regarding their maintenance will be of interest. The cranes, in turn, are periodically inspected and repaired to keep them in first class running condition. At long intervals they are thoroughly overhauled. They are subject to hard service over five miles of yard track and where dirt, sand, clay and particles of iron are prevalent.

The accompanying data shows calculations based on 1922 figures, totaled for the three cranes under consideration. The cranes work on a 10 hr. day and there were 308 working days last year. These figures may be a little higher than usual, due to the extensive overhauling given one crane, but they are not large when the extraordinary wear and tear in foundrý operations is taken into account.

Possible hours of operation	$307 \times 10 \times 3 = 9021$ hr.
Actual hours of operation	8040 hr.
Hours idle for repairs or lack of work*	1170 hr.
Cost of repairs—labor	$2469
Cost of repairs—supplies	$1557
Cost of repairs—total*	$4026
Cost of repairs per hr. of service	$0.50

* One crane down 660 hr. out of a possible 3070 for general and extensive overhauling.

Improvements in methods of handling materials are constantly being planned and executed to save the expense of hand operations wherever possible, and to meet the ever-increasing difficulty of securing hand labor. At present we have under consideration the development of a special storage space, with gantry crane, to hold about six months' supply of our common materials, such as iron, sand, clay, coke and coal.

Changes in plant layout and equipment in a going concern, however, cannot be accomplished as readily as alterations can be made in plans for a new establishment. But many firms must meet cost and labor problems in handling materials, and the present article testifies to the economy of mechanical equipment in the control of these factors.

Posting and Using the "Tell-Tale" Control Board

By CHESTER B. LORD

Class Number
658(004) Management control board

TWO previous articles[1] have stated the principles underlying the exception method of management and the visualization of control facts, and described the Tell-Tale control board as a management device. This paper shows how the facts are posted on the control board and how the Tell-Tale indications bring action.

Manufacturing, or fabrication as it may be called, independent of its nature or the methods used, consists of five basic factors:

(a) Material purchased.
(b) Material in stores.
(c) Material in process.
(d) Product finished.
(e) Time necessary to produce.

Efficient control demands that (a), (b), and (d) be relatively fixed and made equal by basing (a) and (b) upon (d); and that these three vary with the productive rate, which is apparatus actually and completely finished. Items (c) and (e) are also mutually dependent but vary with the schedule rate, which must not be confused with the productive rate, and have no function of actual control.

This is the whole problem of production control, so simple that only a lack of comprehensive visualization and a means of recording that visualization could have delayed its solution; and the three things necessary to its solution are definite budgeting, periodic fabrication, and 100 per cent visualization of conditions.

In Table 2 is shown the Master Material Sheet for repetitive fabrication, which is planned in terms of time without any knowledge of, or regard for, schedule or quantities of material involved. This can be done because it is obvious that the unit of time used, the period which equals one week, may represent either parts for ten or parts for a thousand machines, dependent upon the output schedule required; and by using the period not only a common basis of time is secured but the master sheet is made perpetual regardless of the manufacturing schedule.

It will be noted that each item is taken care of from its purchase, column 4, to its final assembly, column 10, or the (a), (b), (c), (d) and (e) of the problem.

This is part of an actual master sheet as of the date shown; it cannot be explained readily as a whole because each and every item is planned in accordance with its peculiarities of purchase, or difficulty of fabrication, or both. An instance of this is shown in Column 5, whereas most of the items require no rough stock under periodic fabrication methods. Item 11, connecting rod, because of the difficulty of procurement, multiplicity of operations required, and liability of die breakage for this particular rod, as shown by past experience, justified a possible maximum stock of 26 periods or 6 months which at the schedule of 100 machines per week would mean a possible

[1] MANAGEMENT AND ADMINISTRATION, September 1923, p. 319; October 1923, p. 467.

TABLE 2. MASTER MATERIAL SHEET IN PERIODS

—15
Aug. 22, 1921

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Symbol	Name	No Per Appr	Rough Stores		Finished Stores		Bank	Mfg Quantities		In Process			Exceptions
				Order	Min	Order	Min		Fab'cate	Erect	Fab'cate	Erect	Sub Ass'y	
1	C4P-2068	Cylinder Hd. Cover	1	4	0	4	6	2	4	1	0	1	0	#1
2	C4P-2069	Crank Case Cover	1	4	0	4	6	2	4	1	0	1	0	#1
3	C4P-2097	Impeller	1	8	0	8	10	2	8	1	0	1	0	#1
4	C4P-2099	Pump Gland	4	12	0	12	14	2	12	1	0	1	0	#1
5	C4P-2100	Exhaust Nozzle	1	8	0	8	10	2	8	1	0	1	0	#1
6	C4P-2103	Guard	4	4	0	2	2	2	2	0	0	0	0	#2
7	C4P-2620	Pump Gasket	1	12	8	0	0	2	0	1	0	1	0	...
8														
9	S4P-2725	Rear Wheel Tire	2	12	4	2	6	2	2	1	0	1	0	
10	A4P-2226	Rear Wheel Assembly	2	0	0	2	2	2	2	1	0	1	0	
11	S4P-2078	Connecting Rod	2	12	14	8	10	2	8	1	2	1	0	
12	A4P-2079	Connecting Rod Assembly	2	0	0	2	2	2	2	1	0	1	2	
13														
14	A4P-608	Guard	2	0	0	2	0	0	0	1	2	1	0	#3
15	A4P-609	Guard—Side	2	0	0	0	0	0	4	1	0	1	0	#3
16	A4P-610	Guard—Top	2	0	0	0	0	0	4	1	0	1	0	#3
17			Max											Period
18	3/4 Rod	C. R. Steel	4000'	3000'	2000'	0	0	1000	0	0	0	0	0	12
19	Z Bar	C. Dr. Steel	8000'	5000'	7000'	0	0	2000	0	0	0	0	0	12
20														
21	24"-3-2	Carb. Wheel	16	12	14	0	0	2	0	0	0	0	0	8
22	6" 3-Ply	Sp'l. Belting	400	200'	300	0	0	2	0	0	0	0	0	4
23														
24	1/2"-12	H. S. Drills	200	144	168	0	0	24	0	0	0	0	0	8
25	.890	Reamers	40	24	30	0	0	6	0	0	0	0	6	8

but not probable stock at one time of 2600 sets of rods.

Naturally such an item and such a contrast to other items necessitates pausing and planning again in order to justify it to the superior, who naturally notices it when he signs the master sheet. And, incidentally, when he signs the repetitive master sheet he does not authorize any definite amount of material, but only agrees that in proportion to the output schedule fixed, it will be necessary to allow as many periods of material as shown for each item in columns 5, 7, and 12 added together.

This master sheet shows clearly the difference between individual budgeting and blanket scheduling, for with a schedule of 50 machines per week, column 5 shows a total requirement of 1300 sets of parts per week for the items shown, as against a minimum 3800 with the other, and it is assumed even then that the other method will allow as few weeks of stock on hand as we have, which is improbable without proper visualization.

Items 18 to 25 show budgeting in terms of quantity based upon time, as shown in column 14. This method is used where the material is common to several parts and the grand total is less than the combined requirements, or where tools or equipment are of sufficient importance to plan and visualize. They are shown together to contrast time and quantity budgeting.

Table 3 shows a master sheet for the small shop or the large short-order shop for intermittent fabrication, and it will be remembered that repetitive fabrication was defined as "conserving time at the expense of material," and intermittent fabrication as "conserving material at the expense of time," and stated that this was the sole difference between the so-called large shop and the small one; not a difference in size of plants but a difference in size of material lots. So instead of budgeting in terms of time, regardless of quantity, the planning is done in terms of quantity as at present and based upon a definite minimum; but it is taken further, and the time is stated at which it is expected to arrive at this minimum and also the amount of time for which it is necessary to provide. If the time planned, as visualized upon the Tell-Tale, does not coincide with the quantity actually used by being too long or too short, the item comes up for attention automatically, and is either replanned or the exception explained and approved. This prevents any variation on the minus side from being dangerous, or any error on the maximum side from being cumulative. It provides a perspective and a double check.

Item 1, Table 3, shows probably the extreme of budgeting, as it shows that only a single piece is required in twelve months (column 11). This is an exception and is noted as such in red, showing it has received consideration and that it is necessary or justifiable to keep one in finished stores.

Whether it is justifiable to carry a single piece or not must be decided by those responsible. It should be remembered that the exceptional principle is being used; that nothing is visualized but what is necessary, and that material "is conserved at the expense of time," so the chances are that it is justifiable.

Exception 3 means "by permission," that is, a signature is necessary in ordering every new lot, and 12 means "twelve months' supply." Both are an illustration of the wisdom of rule 6 that, "consistency of procedure must never stand in the way of an obvious exception to that procedure or its system," and it is possible to take care of 100 per cent exceptions and not violate a rule or cause confusion. Columns 12, 13, and 14 allow of pricing material and labor and of giving the maximum or minimum investment involved, and by checking against the Tell-Tale a fairly accurate financial inventory is a matter of a short time. These costs are not sent to the shop but are shown upon the copies that the executive signs, thus giving him a definite knowledge in dollars and cents of what he is signing as against a knowledge of time only in the case of repetitive fabrication.

TABLE 3 MATERIAL MASTER SHEET

1	2	3	4	5	6	7	8	9	10	11		12	13	14
PART	NAME	ROUGH MAX	STORES MIN.	FIN	STORES	ORDER QUAN.	BANK	MFG. QUAN.	PERIOD	EXCEPTION		MATERIAL	LABOR	TOTAL
111024	Gear guard R. H.	1	0	1	1	1	0	1	12		12			
111025	Gear guard L. H	1	0	1	1	1	0	1	12	3				
111028	Bracket-oil pump	1	0	1	1	1	0	1	12	3				
1115	Auxiliary cwght	45	30	0	0	30	10	0	4					
11114	Cover	15	10	14	10	10	6	10	4	1				
11122	Pulley	1	0	1	1	1	0	1	12		12			
11125	Cam box	1	0	1	1	1	0	1	12	3				
11130	Bearing	3	2	3	2	2	1	2	12	1				
11132	Bracket	1	0	1	1	1	0	1	12	3				
11133	Pulley	1	0	1	1	1	0	1	12	3				
11144	Column	3	2	3	2	2	1	2	4					
11146	Bracket	2	0	3	2	2	1	2	12	1				
11147	Sheave	2	0	3	2	2	1	2	12	1				
11161	Lever	2	0	3	2	2	1	2	12	1				
11163	Hd clamp	2	0	3	2	2	1	2	12	1				
11227-A	Head	14	6	14	10	10	6	10	4					
11229-A	Head	2	1	3	2	1	1	2	4					
11148	Bracket	1	0	1	1	1	0	1	12	3				
11149	Lever	3	2	3	2	2	1	2	12	1				
11142	Lever	1	0	1	1	1	0	1	12	3				
111031	Neck use cstg 111124	2	0	3	2	2	1	2	12	1				
111061	Pulley	2	0	3	2	2	1	2	12	1				
111062	Pulley	2	0	3	2	2	1	2	12	1				
111065	Pulley	2	0	3	2	2	1	2	12	1				
111066	Bracket	2	0	2	2	2	0	2	12	1				
111067	Cone-pulley	2	0	2	2	2	0	2	12	1				
111069	Stand	3	2	2	2	2	0	2	4					
111076	Bracket	2	0	3	2	2	1	2	12	1				
111079	Box cam drive	2	0	3	2	2	1	2	4	1				

It would seem that such a visualization as either of these master sheets give would be sufficient for control purposes, and it is so theoretically. But it is not a theory that stands forth in this case but a fact; and notwithstanding the general idea as to what an executive should do, the natural limitation remains that we can see and think of only one thing at a time, but may be deceived by the rapidity of sight and thought into the error that it is possible to visualize several things at the same time.

Having planned the repetitive master sheet in terms of time without knowledge of or regard for any subsequent schedule which was perhaps a considerable saving of time, the information is now transferred to

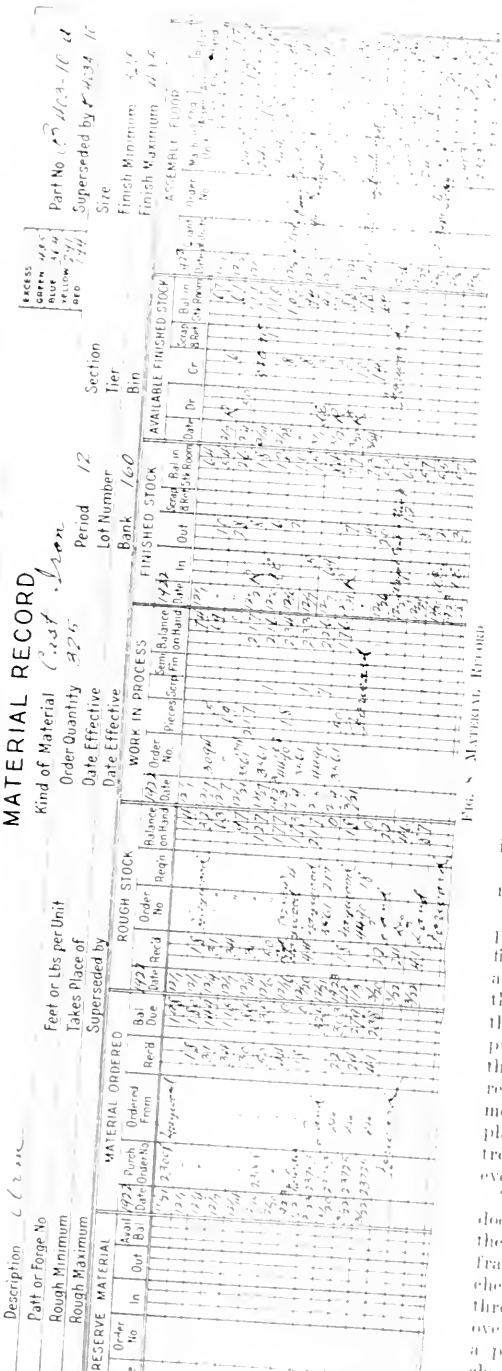


FIG. 8 MATERIAL RECORD

the Material Record, Fig. 8. [illegible] that the imposition of [illegible] did not necessarily [illegible] system where they were glaring errors. Fig. 8 [illegible] of a compromise between the old [illegible] and the new, and while it has simplified [illegible] considerably it is still far from a model [illegible] could be used and the Material Tell-Tale would visualize its essentials were it twice as complicated or much more simple. The cost comes in the added clerical work in making entries. These entries are exact, of course, and are converted into terms of time for visualization purposes, either direct from each sheet or through a separate conversion table, usually the former in intermittent and the latter in repetitive fabrication.

Item 5 in Table 2 would be shown as in Fig. 9, in the place provided for it on both rough and finished

EXCESS	
GREEN	1200
BLUE	800
YELLOW	500
RED	200

FIG. 9 EXAMPLE OF QUANTITIES CORRESPONDING TO CONDITIONS REPRESENTED BY COLORS ON THE "TELL-TALE" BOARD

stores, on a schedule of 100 pieces of apparatus per week on an 8-period manufacturing basis as shown in column 2.

As visualized upon the Tell-Tale, the above figures represent 2-, 5-, 8-, and 12-week supply.

As entries are made on the material records and pass the indicated point the Tell-Tale is changed. The figures given represent the high figure for the zone and really represent the top of it always. It is evident that it is immaterial who keeps the records or who posts the Tell-Tale as the intelligence demanded is for record purposes only, no decisions being required, and yet the one who makes the records and posts the Tell-Tale really directs the activities of the production department and checks the results obtained, but as the planning was done in the first instance, material control, except emergencies, is merely a matter of routine, even while a radical change from present methods.

The question is often asked "But suppose some one does not post the Tell-Tale from the records, what then." Usually there is no answer, no cure for human frailty, but with the Tell-Tale there are several natural checks even on this. In the first place there is a definite three-point check on entries. This does not mean going over them three times, which is not a check but merely a precaution, but, as set forth in rule 5, that "any check to be effective must be obligatory, recurrent and unevadable," so that regardless of the efficiency of visualization, the records may be assumed to represent truly the stores condition, which is included in the check.

The second check is that as orders are received in the combined material, process, and production departments they are routed to the proper desk from the Tell-Tale and are then immediately checked against the records in making out the several orders and requisitions required by the use of "available" material methods; also with the repetitive Material Tell-Tale for straight-line production as the material is shown in terms of time and balanced, the indicators of the same color should descend at a fairly uniform rate, so that an exception would be significant to one with a knowledge of conditions.

But the real and vital reason for the accuracy of indication is because the Material Tell-Tale directs the activities of many departments and each of these from the foundry to the purchase department is energetically interested in its accuracy. Moreover, they do not hesitate to raise their voice when it is not accurate, because the burden of the chasers' excuse for hurry is that "the Material Tell-Tale shows this or that," and it should not be forgotten that all other productive Tell-Tales are synchronized with the Material, some following, some anticipating, also checking it, and thus it is the keystone of production control and forces efficiency and accuracy in the systems and Tell-Tales contributory to it.

The necessity for, and benefit to be derived from 100 per cent budgeting, which takes care of the (a) and (b) of our problem has been shown; and, incidentally, of the minor ones (c) and (e) a method is now required of making these first two dependent upon and fixed by (d), and at the same time simplifying our clerical processes, and this is done by definite scheduling, which, strictly speaking, is not scheduling at all but a time-machine budget.

Under present or corrective methods of management when the drawings for a new piece of apparatus go into the factory the methods department carefully plans tools, operations, costs, and routing once for all. It figures its operation time, its machine capacity time, and assigns each item to a definite machine or group of machines once for all.

Then enter the production department and schedules the part in terms of quantity, and not once for all; it does this because having reached the limit of its power of visualization, it departs from the practice of repetitive fabrication, which is time-replacement, and adopts the practice of the small- or short-order shop of scheduling in excess quantity as being the least liable to cause trouble, and by this quantity scheduling introduces a combination of factors that defies simple solution because they lack a common denominator. This is the beginning and source of production troubles, and attempting to reconcile these factors is the whole problem of production control and is the direct result of our inability to visualize in the mass.

Time is the common basis of capacity, replacement, cost, and work performed, and it is clear that with a definite time-capacity the ideal method would be to plan so that each part, representing a portion of this time-capacity, reached its machine in proper sequence and at proper intervals. This result is readily obtained but not through quantity scheduling, because the scheduling done under ordinary circumstances is the mere recording a guess and expressing a desire which is usually indefinite as to time, capacity, and replacement as a whole.

If a step further is taken and a certain number of parts each month are scheduled, a basis of time will have been established, but the quantities may be too large or too small and will vary in relation to output, (d), and any error is cumulative.

The next obvious step is a minimum point at which to order. But if orders are given at this point time must be ignored, which is the basis of production, and quantities may come too frequent or too far apart for economical purchase and fabrication or else accumulate excess beyond reasonable limits.

It is clear that the option stands of fixing our quantities and varying the time at which they will be fabricated, or of fixing the time and varying the quantity fabricated. If the time is varied, it is clear that capacity, which is also a matter of time but not variable, cannot be controlled.

But with a definite time-capacity of machines and a definite time-quantity of material, it is only necessary to co-ordinate and bring the two together at definite times to solve entirely the question of production control, and only the lack of universal and selective visualization has prevented.

Co-ordination by Periodic Fabrication

This bringing together is accomplished by Periodic Fabrication or fabrication at definite times, dependent primarily upon the economical fabricating quantities of each item, which, of course, is taken care of as part of the initial planning. In repetitive fabrication the recurrent period of fabrication is optional and suggests itself by the nature of the product and the method of fabrication. It is purely a mathematical problem based upon time-cost, time-capacity, and time-investment. The recurring period that normally suggests itself, for instance in a tractor or automobile plant is 4 weeks for large work, such as cylinder blocks, crank cases, etc., and 12 weeks for small screw machine parts, and between the two comes the medium-sized material at 8 weeks, giving 4-, 8-, and 12-period fabrication.

But in any plant all material divides naturally into economic fabricating quantities based either upon size of part, nature of machine upon which it is done, multiplicity of part unit, or some other significant division; and, generally speaking, the purchasing quantity will be the same except where the material is common to several parts such as pig iron, cold-rolled steel, or cap screws, or is a matter of yearly contract, and even in the latter case deliveries and consequently investments are controlled.

On the face of it, it would seem that placing all the large parts in the shop at one time would cause a further congestion instead of affording a relief, but if they are subdivided and certain items are sent into the shop at one definite date and certain ones at another date, the time-capacity peak is still further flattened and a calendar is substituted for a schedule sheet. The Fabrication Order, Table 4 shows how this is accomplished, and the Tool Order Board Fig. 10 shows how this table is visualized and how tool repair and replacement is co-ordinated with material.

This is also an actual table and shows that it requires 24 weeks for a complete balanced cycle, it also clearly shows some of the advantages of periodic fabrication based upon time.

First, it conveys to all interested, information as far ahead as desired, as to when a certain lot-part, composed always of the same items, is due to go into production. The foundry, forge shop, toolroom, maintenance and purchasing departments know that the material, tools, and equipment called for must be ready at the date given; this removes mental inertia and adds the momentum of periodic regularity to the momentum of quantity production. It allows of making out the job cards as far ahead as desired adding only the quantity later and without guessing what that quantity should be. It allows of ordering one class of material at definite times and flattens out the order curve, the receiving curve, and more important still the account payable curve, removes an alibi of the different departments as to ignorance of the time material is required.

The method of fixing the quantities to be fabricated in each lot-part is equally simple and is based upon time-output which is the (d) of our problem, and it is obvious that if all the different factors of production are planned, as shown on the master sheet Table 2, and only that material actually used is replaced, the material can be neither increased nor decreased beyond the planned limits. This is accomplished by basing the quantity to be fabricated upon the number of apparatus finally and completely finished during the same period. Whether in warehouse or sold is immaterial, but they have passed from the control of the shop. If for instance 297 machines are finished in four periods or 4 weeks, two weeks later an order goes into the shop for 297 sets of 4 period parts to replace those shipped out, plus, of course, any scrap or replacements, and in the meantime purchase and foundry orders for identical quantities have been placed upon an "available" basis. If 517 machines are shipped in 8 periods, two weeks later orders go into the shop for 517 sets of 8 period parts, the same is true of the 12-period parts.

TABLE 4 FABRICATION ORDER TABLE GIVING SEQUENCE IN WHICH ORDERS ARE ISSUED[1]

DATE	LOT PART	PERIOD	DATE	LOT PART	PERIOD
1- 3	4—1	1	3-28	4 1	13
1-10	8—1	2	4- 4	8 2	14
1-17	4- 2	3	4-11	4 2	15
1-23	12—1	4	4-18	12 1	16
1-30	4—1	5	4-25	4 1	17
2- 7	8—2	6	5- 2	8—1	18
2-14	4 2	7	5- 9	4—2	19
2-21	12- 2	8	5-16	12 2	20
2-28	4 - 1	9	5-23	4 1	21
3- 7	8—1	10	5-30	8—2	22
3-14	4- 2	11	6- 6	4- 2	23
3-21	12—3	12	6-13	12- 3	24

[1] The periods and lot numbers start the first Monday in the year. All four (4) period lots are odd, and all odd numbers are four (4) period lots.

It requires twenty-four (24) weeks to make a complete cycle.

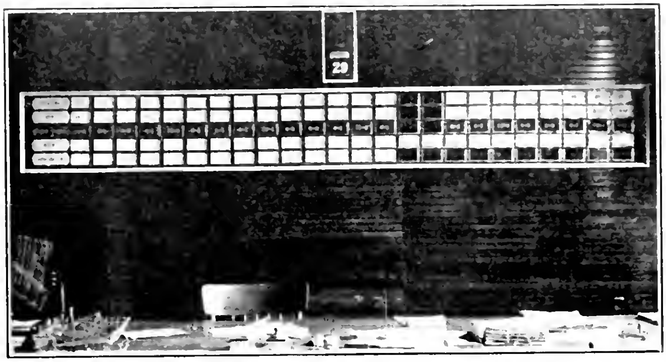


FIG. 10 THE TOOL ORDER BOARD

The time allowed for making out orders is immaterial provided the input be based upon the output for the same periods, or (a) and (b) based upon and fixed by (d), which was the whole of our problem. Quantity will have been reduced to a time basis and if time is made always equal for the same parts and recurrent in the same order, the schedule sheet will be eliminated entirely and a calendar substituted, because time-replacement, time-fabrication, time-capacity, time-cost, and time-investment have been determined, and the fundamental is observed that—"time being the basis of manufacture, to be intelligible and comparable, all factors must be in terms of time" and rule 1 has been conformed to that—"in repetitive fabrication, the purchase, fabrication . . . of material is based upon the actual product finished."

If final assembly or test be not the limiting feature, our input can be based upon the output of a limiting machine, or when running below capacity upon the output schedule, but it must conform to rule 1.

Aside from, and beyond the simplification of process, the elimination of continuous scheduling, and correspondence with its consequent irritation, there is also the direct benefit of a compulsory, increased material turnover.

Such a definite saving, so clearly demonstrated above, should surely command the severest consideration of every executive interested in financial control.

It is impossible to discuss the whole management or to explain fully any one phase of it within the scope of a few articles. That part of it dealing with the co-ordination and measurement of management, and its adaptability to visualizing emergency orders and conditions, has been perforce omitted from this discussion.

THE EDITORS' PAGE

Capital Requirements and Control

ONE of the cardinal requirements of good factory management is the careful regulation of material. This extends from its purchase through to its conversion into finished goods. A shortage of material or parts means a slow-down or perhaps a shut-down of the factory with its serious resulting loss. A failure of finished goods means that orders cannot be filled promptly with a resulting ill-will and financial loss that may be very serious.

On the other hand if material or finished goods are in excess of the requirements there is a loss in carrying charges and in interest on the tied up capital. Also fluctuations of prices may involve an undue loss on inventories, and, most dangerous of all is the possibility of so locking up capital that the general operations of the business are crippled or perhaps brought to disaster from the lack of fluid capital.

All this is known to every competent factory manager. But how many of them guard their capital investment with the same watchful care they accord material? Yet the conditions and effects of an under- or oversupply are much the same. An oversupply means a loss either in the form of unnecessary interest or in the reduced dividends when the same amount of profits is spread over the larger capital investment. On the other hand if there is not enough capital the business itself is crippled and may be—and frequently is—brought to bankruptcy.

Mr. Barber in his article "Estimated Monthly Collections of Cash" presented elsewhere, states briefly but well the situation in regard to working capital:

> It is recognized as an ideal that those in charge of the finances of the business should supply only that amount of working capital which can work continuously and thereby assure its owners a maximum return. They should not furnish more than that amount because any idleness of the excess, even temporary, will reduce the average rate of return upon their total working capital.

Mr. Barber here stresses the fact that working capital can be, and should be, kept down to the minimum that can be kept working continuously; for any additional requirements for emergency calls or peak loads can be provided for by short-term borrowings.

With some modification his statement applies to fixed capital with equal force. The capital invested in plant and equipment cannot be cut so closely as in the case of working capital, for temporary additions to care for unusual demands or peak loads are not usually possible and the permanent investment must be sufficient to give reasonable elasticity. Given this, however, and anything more means a loss in depreciation and in unnecessary interest or reduced dividends. On the other hand, anything less than this means loss of business from inability to supply its demands.

As a rule failures to gage capital requirements with fair accuracy do not run to insufficient capital. This is one of the commonest causes of business failure. The insufficiency is not usually, however, due to any miscalculation but to inability to secure the capital that is really needed. Where discretion is possible, excessive capitalization is by far the more common error. Money is "hard to get and heavy to hold" and those in charge of the finances are apt to look with complacency upon a capital investment and a cash balance far in excess of any actual requirements. The error is on the side of safety but there should be no material error in either direction. It is possible to calculate capital requirements with reasonable closeness. Enough more to provide a "safety cushion" is a wise precaution. Anything beyond this is bad management.

Reducing the Cost of Materials and Handling

IN an article appearing in this issue, Shellman B. Brown describes materials handling methods in use at a plant quite typical of many throughout the country. Founded almost 70 years ago as a small concern, this plant has developed and expanded gradually until now it occupies a large area, has about 40 buildings of various sizes, employs 650 men and takes in well over 100,000 tons of materials annually to use in making its product.

At first isolated boilers and engines for power, mules and carts for transportation, and hand labor for all operations, were the rule. As time went on and the demand for better methods grew, these systems gave way to a central power plant, locomotives, cranes, trucks, machinery for turning out the product, and mechanical and electrical equipment for handling materials. This has been the history of many establishments engaged in the industrial field today.

Among the changes made, the control of materials has contributed a large share toward economy and profitable operation. Mr. Brown makes a direct comparison in three instances between certain hand methods still in vogue because of the great difficulty of completely adopting new plans, and corresponding mechanical methods of doing the same kind of work, where improvements have been introduced. He describes many of the systems followed in his plant to avoid the rehandling of vast quantities of heavy materials. He points out that equipment is more than economical; it is a necessity on account of the lessening number of men available for laboring work, and the decline in willingness of those who are left, to do as much in a day as men of a generation ago would do in the same number of hours.

All men in industry who are responsible for getting work done, especially that involving hand labor, will bear the same testimony, that the control of the situation in materials handling has passed beyond the stage where it can rely on human muscles to accomplish the task. But enough has been demonstrated of the importance of this phase of manufacturing to justify classing it as one of the major problems demanding an answer. Mechanical equipment, reduction of inventories, well-regulated purchase and stores methods, improvements in design, facility and dispatch in manufacturing and routing processes, are only a few of the elements involved. The art is still young, the opportunities for betterments in many lines are great, and necessity will open up the various ways to effect economies and establish control.

Meanwhile, the process of gradual improvement in one branch or subdivision of plant operation after another, where the handling of materials is involved will provide a better and better basis upon which to build the large and comprehensive mastery which good management is bound to achieve. Reduction of costs will follow.

Lowering the Cost of Distribution

PRODUCTION wastes in industry have been cut to small percentages where good management has been applied to the effort. But in practically every line of business distribution wastes are vast by comparison.

The negotiation of sales, because it deals so largely with human factors, will require long, careful study and slow action in its improvement. That part of distribution concerned with material elements, however, can and should be bettered at once. One phase of this subject is fully discussed by B. L. Huestis in an article published in the present number.

Mr. Huestis states that $18,000,000 is paid annually by railroads in damage claims arising mainly from poor containers. This amount does not include losses nor theft. Freight earnings, of course, have to make good this waste.

The total expended annually in the United States for boxes and crates is $500,000,000, which represents only containers made by manufacturers engaged in this special business. Packing boxes, crates, and other containers made by the shippers of commodities themselves run the figure up into very much higher amounts. It is possible to build simpler and lighter crates which are at the same time two or three times as strong.

The savings within reach of the individual manufacturer in shipping his product are large and come from three sources: Less cost of labor and materials in making crates and boxes; lower freight bills due to lighter containers; elimination of the time, trouble and expense of collecting damage claims from railroads.

The article gives many valuable suggestions on the design and construction of crates, and of wood and plyboard boxes. Comparisons of strength, and methods of testing containers are explained. Proper ways of packing and protecting articles are described and points to be kept in mind when loading freight cars are outlined. The article is intended to be directly helpful to every plant and is based on years of experience by the American Railway Association.

To prove the economy of good design and construction of freight containers, the author gives some actual figures of savings accomplished. The outstanding [illegible] by a [illegible]

Lowering the [illegible] of every concern. On[illegible] has been made. Among the several [illegible] before industry at the present time [illegible] a prominent place. It has several phases which MANAGEMENT AND ADMINISTRATION will in turn [illegible] upon its pages.

Clipping and Filing This Magazine

MANY readers have asked if MANAGEMENT AND ADMINISTRATION was intended to be bound as each volume is completed and kept in book form for reference. The invariable answer has been, "Yes, the magazine can be bound and made a permanent addition to any library, and a printed index is supplied for each volume to facilitate its use as a book."

However, the number of subscribers who bind is small compared with the total. Most readers use the magazine currently. It cannot be expected that every article will be useful to everyone. Rather each will make his own selection in keeping with his present and future needs. For this reason in make-up and arrangement particular attention is paid to convenience for clipping and filing.

To enumerate, every article is complete in itself, no part of it is continued to another section nor is any illustration or table printed outside of the text matter. Every major article begins on a right-hand page. This arrangement means that any such article can be removed from the magazine—clipped—without touching any other article. Each is a complete unit by itself. Furthermore every article is classified, indexed, and the index number is printed as a part of the title. This expert work is done for the magazine by the Engineering Societies Library.

The thought behind this plan is to make MANAGEMENT AND ADMINISTRATION of the greatest possible usefulness to its subscribers.

Equipment and Service News

THE new department announced a month ago, "News of Equipment for the Management," is in this issue, pages 635 to 640. It gives the essential facts of new equipment and service which may be used in industrial operation. It is planned to be useful to the reader by calling to his attention things which he might adopt with profit.

Inasmuch as the source of these items of news is the producer of the article of equipment or the service offered and these are reputable manufacturers and consultants, MANAGEMENT AND ADMINISTRATION assumes that the information received is true and authentic. On this basis it is presented to the readers.

From now on it will be a regular monthly feature covering in general seven classes of items: building construction and materials; material handling equipment; general office appliances and supplies; power generating and transmission equipment; general shop materials and supplies; electrical equipment and supplies; and publications and consulting services.

THE READERS' PAGE

Judge Day on Business Insurance

Editors of MANAGEMENT AND ADMINISTRATION:

I am much impressed with the article by Judge Day of the Equitable in your August issue, under the title "Insuring the Executive Asset."

Judge Day not only brings out sharply the urgent need of business insurance, but shows that this necessity is only beginning to be appreciated, and that we are entering an era in which the growth of business insurance will be enormous. This is inspiriting to all who are engaged in the insurance business, and particularly to those who have recently entered it, for it indicates that they are "in on the ground floor" and have an opportunity to grow as this remarkable movement develops.

Our agency publication, "Provident Notes," has been giving much attention to the topic of business insurance for some time. Judge Day's article contains a number of paragraphs which we wish to quote in future issues.

WILLIAM S. ASHBROOK,
Agency Secretary, Provident Mutual Life Insurance Company

The Human Element in Management

This letter, which combines discriminating observation and welcome encouragement to the editors, is from a subscriber to the magazine who resides in Long Branch, New Jersey:

Editors of MANAGEMENT AND ADMINISTRATION:

In remitting for my subscription to your magazine I want to express my appreciation of your recent editorial on management.

Those gentlemen down Boston way may be able to figure out by their charts, to their own satisfaction, just how many brass tacks will be needed between now and the thirty-first of next August, but, as Bobbie Burns wrote a good many years ago, "the best laid schemes o' mice and men gang aft agley."

After you have built your management machine, perfect as it may be, you still have the human element to deal with. That is a beautiful plan of the Westinghouse people to pick out the perfect men for their business. But let your memory go back to school days and recall the dull, heavy boy at the foot of the class, who never was able to keep up with the rest of the boys, and who, since he became a man, has towered over all the rest in achievement.

You cannot judge by appearance. Always there is that unknown something which makes or mars the plan. I might cite the case of a red-headed boy who now occupies a high position in the financial world in your city. It's dollars to donghnuts he could never have passed any Westinghouse test. But he has the job and is holding it down.

Let us have horse sense, and not be so cock-sure that the particular plan or plans we have developed are absolutely perfect, and that all the hard work men have done before us is worthless. It strikes me that some of the old fellows laid down some pretty good foundations for us to work on.

Go to it! If you do not turn out the perfect manager you are looking for, or the administrator who always decides wisely, you will have made good effort that will not be lost. Some one may see a bit more clearly for your labors. Some one may put away his discouragement and win out in the end. The best of success to you!

CHARLES VAN BRUNT, JR.

Interest on Capital Investment

THE correspondence which follows embodies a very definite question and an equally definite answer. The question comes from Lynn, Massachusetts, and the reply from a well-known authority on accounting, connected with Coffield, Sanders and Company, of Indianapolis:

Editors of MANAGEMENT AND ADMINISTRATION:

At the present time I am very much perplexed with the question of figuring interest on capital investment. As a subscriber to your magazine, I would appreciate it very much if you could find time to assist me in clarifying this subject. The more I read about this subject, the more I become confused, as there is a very great difference of opinion concerning the advisability of charging off interest on invested capital as an expense.

The particular business referred to is that of a trading corporation. The problem is this:

Shall interest on the average capital employed during the fiscal year be charged to the Interest account and a correlative credit be made to Surplus account? By handling the interest in this manner the net profit for the fiscal year would be correspondingly reduced. Would this interest be an allowable deduction in determining the net income for the period on the federal income tax report? If so, aren't there a great many concerns which are losing money through taxes by not taking advantage of this method?

My own personal opinion is that this is nothing more than a means of evading taxes. For an illustration I would use the following figures taken at random:

Take the case of a close corporation with a capital stock of $250,000, $100,000 of which is secured by a long-term note which it is intended should never be paid, and bearing no interest; the surplus at beginning of period being $55,000 and the net profit for the period being $30,000 before taking interest on invested capital into consideration). Taking one-half the net profit and adding it to the capital stock and surplus, there would be an average capital employed amounting to $320,000. Figuring interest on this at 6 per cent per annum, there would be $19,200 deductible as an expense, thereby decreasing the net profit to $10,800 on which the income tax is to be figured.

Another thing that puzzles me is this: Should not the $100,000 subscribed for capital stock by a note be deducted from the invested capital so that the invested capital shall represent actual values received only? Otherwise, why could not an additional $200,000 be subscribed for capital stock? The amount which would then be deductible for interest would be $31,200, making a net loss for the year of $1200. Personally, I do not see what justification there would be in charging off this interest, but the president of the corporation of which I am assistant treasurer persists in saying that it can be done and that it is logical. To verify his statement he referred me to a 1918 tax return on which such a deduction had been made.

ARNOLD C. SONEY

Editors of MANAGEMENT AND ADMINISTRATION:

The objections of Mr. Soney to the computation of interest on capital investment as a deduction from taxable income are all well founded. There are times when for cost keeping or other purposes it may seem desirable to consider such interest as an expense. The arguments as to when and if such a course is proper have taken many pages of print which it seems useless to attempt even to summarize here. If Mr. Soney cares to go further into this phase of the matter he might be referred to any standard text on accounting and especially cost accounting.

The point where he seems to have been confused is expressed in his letter in the following words: "Shall interest on the average capital employed during the fiscal year be charged to the Interest account and a correlative credit be made to Surplus account?" The answer to this question is—"No," because even if interest is to be considered as an expense the correlative credit will not be to Surplus but to Interest Income and hence to Profit and Loss of the year in question.

Such a computation of interest expense cannot be deducted under federal income tax laws. This is not only good accounting but it is also good logic (which is true of all *good* accounting). The Department has specifically ruled on this question in connection with each of the last three revenue acts. Article 187 of Regulations 33 (applicable to the Act of 1917) says:

> Interest calculated as being a charge against income on account of capital or surplus invested in the business but which does not represent a payment on interest-bearing obligation, is not an allowable deduction from income—that is to say, the interest which the money would earn if otherwise invested is not a deductible charge against income.

Article 122 of Regulations 45 (applicable to the Act of 1918) gives exactly the same rule except that a comma is inserted after the word "business" and the dash after the word "income" is changed to a semicolon. Article 122 of Regulations 62 (applicable to the Act of 1921) changes the phraseology to read:

> Interest calculated for cost keeping or other purposes on account of capital or surplus invested in the business but which does not represent a charge arising under an interest-bearing obligation, is not an allowable deduction from gross income.

The fact that the president of the corporation referred to a 1918 income tax return on which such interest had been deducted from the taxable income does not have any bearing upon the case for the reason that the Department is far from completing its work of auditing 1918 returns. This hope of saving taxes rests on a very weak foundation because the writer does not know of any taxpayer who has *permanently* avoided the assessment of tax by the claiming of such interest as a deduction.

The question as to whether the $100,000 subscribed for capital stock and paid for by a note is to be included in the invested capital must be answered in the negative. If the note bore interest which was paid regularly there is a strong possibility that the allowance of this amount as invested capital could be secured, but its inclusion under the circumstances named (that the note is never intended to be paid and bears no interest) would be permitted only by virtue of an oversight.

The writer notes that in calculating the amount of interest on the capital invested Mr. Soney has added one-half of the net profit of the year to the capital at the beginning of the year in order to obtain the amount of capital invested. He probably understands that for purposes of determining invested capital in the computation of income tax no part of the current year's profit can be included. Since this calculation of interest, however, is purely for a book entry and is not dependent upon any law or upon any contract (except for the general provisions that it is not deductible expense) he can of course calculate the interest in this way if he sees fit.

P. W. PINKERTON.

Protecting Employees' Savings

Editors of MANAGEMENT AND ADMINISTRATION:

Industrial executives of today freely acknowledge their responsibility for safeguarding in every possible way the welfare of their employees. I therefore venture to suggest to your readers a definite way in which this safeguarding, in so far as it concerns the investment of the employees' savings, may be furthered.

The Better Business Bureau of New York, affiliated with organizations of similar name in 38 other cities and with the National Vigilance Committee of the Associated Advertising Clubs of the World, has the following definite purpose:

> To further and promote honesty, truthfulness, and reliability in merchandising and advertising of all kinds; to discourage fraudulent and deceptive methods in business and

thereby to increase public confidence in advertising, salesmanship, and business generally.

Publicly, the Bureau is known mainly for its exposures of securities swindling and its activities in bringing about the prosecution of flagrant cases in this field. However, other important results are obtained by quiet effort of which the public seldom hears. The Bureau's constant functioning in gathering and distributing facts about doubtful securities and vendors, which are made available to business firms and to individuals on request, is a growing part of its tangible service to the business community.

Fake promoters and bucketeers have, particularly during the period of high wages following the war, taken millions from the wage-earning class of workers in the United States. Executives can help their employees by co-operation with the Bureau in its vigorous fight against these unscrupulous vendors. Such cooperation might take the form of direct support of the Bureau through membership, or through the reporting to it of all questionable sales effort among their employees, or both. Co-operation is now being received from banks and investment bankers, brokers, public utility companies, and savings banks. The Bureau will be glad to hear from industrial executives or others who are subscribers to your magazine, and who wish to work with us as I have suggested.

H. J. KENNER.
President, The Better Business Bureau of New York City, Inc.

Balance of Labor

THIS letter, from the Supervisor of Planning of the Washburn Company, connected with the Andrews Wire and Iron Works Division of the Company at Rockford, Illinois, asks for the experience of other executives in meeting the problem of balance of labor. The editors will be glad to give space in this department to suggestions based on the statements made in Mr. Green's letter.

Editors of MANAGEMENT AND ADMINISTRATION:

One of the chief features of a plan of effective factory management is the balance of stores. This is, of course, an arrangement whereby sufficient materials to manufacture the goods required are assured, as a constant but not excessive supply of materials is essential to economical manufacturing.

But material is only one element entering into fabrication, and is certainly not more important than the labor required to convert the material into stock. Yet very little has been written about a mechanical means of keeping a balance of labor, of assuring a sufficient labor supply in all departments and avoiding an oversupply of labor in times of decreased production.

In plants where an effective routing system has been installed and scientific time study is in vogue, the securing of a balance of labor should not be a very difficult matter. By multiplying the number of employees in a department by the number of working hours per week, the available hours per department for any week can be determined. As a route sheet is made out for each manufacturing order before it is started, and as the approximate time required to perform each operation is shown on the route sheet, it ought to be a simple matter to determine the hours of labor necessary in each department to complete the order.

A comparison of the labor available for a given period of time with the labor required to turn out the work needed in that period should show how the labor supply stands, and whether the work can be turned out on schedule or not. As each operation is performed, the labor used can be deducted from the available supply and the labor needed, so that the equation should always be in balance.

I should be glad to hear what other executives have done or are doing along this line, and what mechanical means they have developed to achieve satisfactory results.

HAROLD G. L. GREEN.

Knoeppel Articles Appreciated

This letter, from the vice-president of the B. F. Sturtevant Company, Hyde Park, Boston, is one of a number that have been received expressing satisfaction with the series of articles recently contributed to the magazine by C. E. Knoeppel:

Editors of MANAGEMENT AND ADMINISTRATION:

I am very much impressed with the practicability of the statements made in your series of articles by Mr. C. E. Knoeppel.

It has always seemed to me that many of the trade papers publish articles which perhaps offer good suggestions, but which are theoretical and impractical in the extreme and some of them anything but accurate.

I well remember walking home one night with an advertising man who said he was going to write an article for a certain publication on a subject with which I was very familiar. He said he was to receive, as I remember it, $25 for the article.

I smiled to myself at the time and offered no comment. I was certain that he knew practically nothing about the subject. I watched the trade paper, however. Later, sure enough, the article appeared. It no more covered the subject than I could if I attempted to write an article on the great war, or the causes of the earthquake in Japan. In fact, the article throughout was full of inaccuracies.

Up to that time, as a young engineer, I had religiously read the trade periodicals. But I decided then and there that I was wasting my time. Since then I have asked our assistants to call to my attention any particularly useful articles, but aside from that I seldom read anything in these publications but the advertisements.

But Mr. Knoeppel's articles, excellently written and thoroughly practical, have changed my attitude completely.

E. B. FREEMAN.

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

PREPARED BY LEWIS H. HANEY

Director, New York University Bureau of Business Research

Barometer of Industry and Trade

Better Business Seems Assured by March 1924

The outlook for business and industry for the next six months is better than it was a month ago. October figures will doubtless show further recession and there will be much irregularity during the remainder of 1923. But improved business is in prospect for the spring of 1924. Accordingly, greater strength in the stock market is probable within 30 days—of course barring unforeseeable political developments.

The main forecasting line, the P V line, turned upward strongly in September. A point to be emphasized is that it now lies above the interest rate curve, indicating both that there is an improving demand for commodities in prospect and also that funds are relatively easy to obtain. Conditions indicate that the much-needed readjustments in production and price levels are in process and that, with the lapse of sufficient time for working themselves out (five or six months), improvement will begin.

The rise in the main forecasting line is due to a favorable combination of the price level and production. In the first place, the general level of wholesale prices on October 1, was about 1.3 per cent higher than on September 1. In the second place, physical volume of trade decreased about 6 per cent. This necessarily means a trend toward a stronger demand which tends to establish firm or rising prices and a higher level of industrial and business earnings. The relatively easy money rate is an advantage.

Unless some "act of God" intervenes, therefore, the business recession of 1923 should turn the corner in the fall, probably in October and a business upswing of moderate proportions begin within six months. September has told the story. There has been a real minor depression and an important recession in basic industries. But equally real progress is now being made in effecting the necessary readjustments which will ultimately bring improvement.

The immediate outlook is for unsettled conditions. During the period of readjudgment, which will extend at least throughout the balance of the year, we will have great irregularity and "spotty" conditions. The decline in industry has been too sharp and the accumulation of stocks of basic commodities too great to allow any immediate general improvement. Also, business and industry are confronted by serious uncertainties in the shape of European unsettlement and unwise action threatened by Congress.

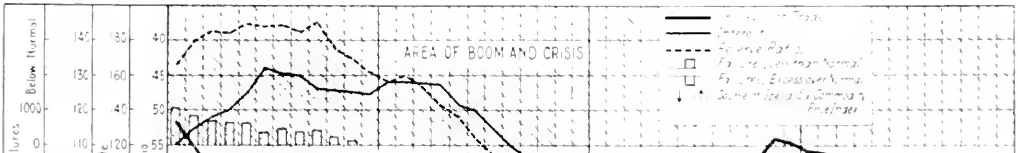


Fig. 1 The Barometer of Industry and Trade

Areas in which curves lie indicate that business is good, normal or poor, respectively. Curve P V shows the trend of commodity demand, and is the ratio between Bradstreet's index of wholesale prices and physical volume of trade (carloadings times tons per car), based on 1912 as the normal year. A rise in the curve indicates increasing demand, and vice versa. Interest rate curve has been corrected for seasonal variation, and index number 100 equals 5 per cent. Federal reserve ratio of cash reserves to note and deposit liabilities is inverted to harmonize its indications with the rest of the curves, and is corrected for seasonal variation on revised basis from January 1923 on. Business failure bars are based on Dun's reports, and "normal" equals the trend for 40 years. Six Commodity price index based on N. Y. U. Bureau special investigation. October 1923 data shown is probable trend.

The fundamental, long-run fact, however, is that at last there has come a curtailment of the industrial output which is sharp enough to check the decline in the price level. On the one hand, production in basic industries and railway tonnage are being checked (see Fig. 2) and curtailment is evident in the production of petroleum, pig iron, bituminous coal, and cotton textiles (see Figs. 3, 4, and 5). Imports also continue to decrease. On the other hand, prices are working irregularly higher as shown by both Bradstreet's and Dun's index numbers. While there may be some further declines shown by the indexes on the first of November or December, it now seems likely that the general price trend during the next six months will be upward. The steadily increasing volume of our stock of money and of money in circulation tends to support this conclusion.

While the September barometer forecasts improvement, the various graphs shown herewith clearly indicate that during September business and industry declined to lower levels. The outstanding fact is probably the further recession in building activity (see Fig. 6). Railway tonnage declined. The production of bituminous coal fell. New business enterprises incorporated were at a low level. There was a bad situation as to the stocks of commodities in several basic industries. The price situation was very irregular, and the stock market showed continued weakness.

On the other hand, evidences of an improved outlook for the future are beginning to accumulate. Bank debits in September, after allowing for seasonal variation, showed a good gain. The loans and discounts of 770 member banks showed a small but distinct increase. Mail order sales recovered from the August slump and increased by an amount greater than the usual seasonal gain. This may be connected with the advance in farm prices. In any case there was an upward trend of farm prices during September which brought the index for the principal farm crops to a point nearly 28 per cent higher than a year ago—an increase of 2.2 per cent for the month. Prices of hogs, cattle, sheep, and poultry, while not quite so high as a year ago, increased over 7 per cent between August 15 and September 15. The general trend of business failures is downward. The long-delayed liquidation in the oil business appears to have been carried out, and a similar readjustment in the iron and steel business is under way. (Probably the latter industry is not at the bottom yet, but the Japanese building requirements will help it directly or indirectly.)

In general, therefore, we may conclude that a policy of caution in making commitments should be followed during the rest of the year, while the price level is still somewhat uncertain and keener competition is in prospect. The outlook for better conditions in February or March 1924, is bright, and sometime about the "turn of the year" greater freedom in forward buying and making commitments for spring business may logically be anticipated.

During the immediate future there are three possibilities: (1) an upswing; (2) a downturn; (3) a substantially level condition of business. There is no indication of an immediate upswing, and the evidence is mostly against any further downswing than that due to the momentum of the decline already under way. This has already been largely discounted. Indexes of the interest rate, prices, business failures, and volume of trade, all support the conclusion that there is no major depression in immediate prospect. We may therefore expect an irregular level to be reached in October which is not much above that of a year ago and which will be characterized by spotty conditions and numerous readjustments. During this period our industrial output must be adjusted to the smaller export market. Farm land values and excess crop areas must be liquidated, and various uncertainties, legislative and other, must be cleared up. (One great maladjustment, namely the high level of urban rents, together with low purchasing power of salaried persons, probably remains for a subsequent period of liquidation.)

At the end of this period of irregularly level conditions there are again three possibilities—(1) an upturn; (2) a downturn; (3) a continuation of the level trend. As already stated, a moderate upturn seems the logical forecast. That upturn should come in the spring of 1924. Barring inflation, the outlook at present is not for a very sharp gain at that time and it does not seem wise at present to attempt to forecast how long the gain might continue. It seems rather probable that the rise in prices will not be very great.

Much depends upon the question of inflation, a question which still confronts our nation. It cannot be denied that the possibility still exists in view of the resort to farm credits, the possibility of a bonus bill passing and politics in the Federal Reserve Board. There is no sign of inflation yet. Probably there is a certain amount of inflation in our currency, but a study of such indexes as the interest rate, the volume of loans and discounts, the federal reserve ratio, note circulation, and price levels, shows that the disease has made no considerable progress yet. As long as this holds true, no extended advance in the general price level seems likely. (In fact, the general trend during the next 10 years should be toward lower price levels.) But if inflation comes, it will probably be next year. Then there would be a boom followed by a severe crash.

Production and Stocks of Commodities

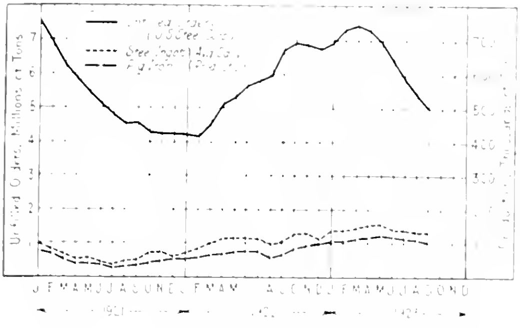
Production Still Dropping: Stocks Little Changed

Our index of gasoline stocks in Table 1 shows a further rise at the end of August. It is now 199, compared to July's figure of 185. Newsprint paper stocks also show a rise. The index for automobile tire stocks shows a decline

Sources, Federal Reserve Board, N. Y. U. Bureau of Business Research

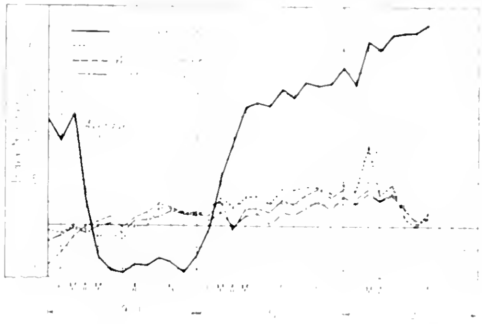
FIG. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

Railway tonnage and basic industries production corrected for seasonal variation, and the latter also for normal growth.



Sources, Iron Age, American Iron and Steel Institute

FIG. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS



Sources, American Bureau of Metal Statistics, Federal Trade Commission; Bureau of Census, Dep't of Commerce

FIG. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES

of nearly 10 per cent due to the curtailment of production in that industry. In view of the great overcapacity in this line of manufacture, however, this fall is probably not large enough to denote much improvement in its position.

Other noteworthy facts are the relatively low level of stocks of refined cotton-seed oil, and the gain in refinery stocks of raw sugar.

Production and Railway Tonnage

Railway Tonnage. A further recession in industry during August and September is shown by the curves in Fig. 2. The outstanding situation is the sharp decline in railway tonnage after the index is adjusted for seasonal variation. September tonnage is generally a little above that of August but this year the figure actually declined over 6 per cent which brings the curve to the lowest point reached since February.

Production. Production in basic industries, when the seasonal variation factor is eliminated, fell in August to 119 from the July figure of 121 (the monthly average for 1921 equals 100).

Conclusion. The decline in industrial activity which began in June has at last affected the volume of railway traffic. The decline in forward buying which began in May now finds expression in smaller deliveries of freight in September. The fall of the production curve, approaching closer to the curve of freight traffic, indicates the beginning of a curtailment which during the next two or three months will relieve the pressure of accumulated stocks at plants.

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
(Index Numbers. Average for 1921 = 100)

Month and Year	Gasoline*	Leather (Cattle)	Zinc	Newsprint Paper	Automobile Tires	Raw Sugar	Cotton-Seed Oil
	100 = 630,757,000 gals	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,009 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.
Jan. 1921	89	100.7	52.2	82.5	126.2	55.9	107.4
Feb.	93	102.5	98.4	108.0	121.9	54.5	114.1
Mar.	92	102.1	101.1	130.5	119.0	86.1	140.9
Apr.	92	102.5	104.9	139.3	105.3	76.8	144.2
May	104	100.8	103.1	117.0	103.7	164.7	146.0
June	103	101.4	108.4	104.0	102.0	196.5	130.8
July	109	100.5	116.4	88.7	95.2	170.0	117.3
Aug.	108	99.5	119.7	85.0	89.2	106.1	89.4
Sept.	109	99.5	112.1	90.4	90.2	97.4	61.0
Oct.	102	96.1	105.1	100.8	76.6	93.8	34.2
Nov.	102	95.9	91.7	76.7	81.2	48.9	46.0
Dec.	103	95.2	86.8	77.1	89.6	48.9	74.2
Jan. 1922	110	98.5	78.5	79.8	84.7	27.5	101.2
Feb.	110	99.0	85.1	88.5	95.6	46.7	107.7
Mar.	110	100.7	83.1	92.7	107.5	116.1	113.3
Apr.	110	95.4	78.1	93.9	118.8	202.2	117.3
May	111	101.5	67.0	82.9	125.2	197.8	118.7
June	114	101.6	52.3	82.6	126.6	179.5	99.8
July	123	98.3	38.3	77.9	115.5	166.8	82.7
Aug.	133	97.4	37.1	70.5	110.8	208.5	64.4
Sept.	146	91.5	28.0	66.3	106.1	148.0	41.7
Oct.	161	90.2	24.4	62.7	105.7	99.0	20.8
Nov.	160	87.7	23.4	65.8	107.3	49.6	22.6
Dec.	156	85.9	25.3	65.4	113.8	28.2	36.8
Jan. 1923	156	85.3	23.6	61.0	105.4	15.8	57.0
Feb.	154	84.0	21.5	76.7	107.6	40.2	77.1
Mar.	162	82.6	14.1	77.3	119.7	73.4	88.6
Apr.	164	81.6	13.0	67.2	129.9	184.3	93.9
May	173	81.4	11.6	62.9	139.3	211.1	92.3
June	174	82.1	16.9	60.5	159.6	166.6	87.2
July	185	82.8	22.2	65.0	161.4	151.0	75.1
Aug.	199	83.6	27.5	83.0	148.0	118.8	51.0
Sept.	....	84.3	34.4	84.5	138.5	91.6	27.0
Oct.	....	....	29.6	....	....	105.3	

*Last of month; adjusted for seasonal variation.

Iron and Steel Production

September showed a further decrease in the production of pig iron and steel. The details as presented in Fig. 3 are as follows:

Production. The average daily production of pig iron decreased to 104,184 tons, as against 110,816 tons for August, a decline of 6 per cent. Steel ingot production for September totaled 3,313,351 tons, a drop of 2.5 per cent from the August total of 3,677,771 tons, and the average daily production decreased from 136,276 tons in August to 132,534 tons, a decrease of 2.7 per cent.

Unfilled Orders. Unfilled orders of the U. S. Steel Corporation as of September 30, were 7 per cent lower than August 31. The figures were—August 31, 5,414,663 tons and September 30, 5,035,750 tons. This decline was not as great as the drop from July 31 to August 31 which was 8.4 per cent.

While consumption of steel is still heavy it has recently dropped and shipments are in excess of new orders.

Price. Pig iron prices are considerably weaker with \$19 for Birmingham and \$22 at the latest report prevailing in Buffalo. The Chicago price is reported at \$25, although this market is nominally on a \$26 basis. In eastern Pennsylvania the price is \$23.

Prices of finished steel have lately shown a yielding tendency, though plates, shapes and bars hold up fairly well. Composite price indexes from the *Iron Age* are shown in Table 2.

TABLE 2

"IRON AGE," COMPOSITE PRICES

	Pig iron (per ton)	Fin'd steel (cts. per lb.)
Oct. 17, 1922	\$30.27	2.460
Sept. 18, 1923	25.04	2.775
Oct. 9, 1923	23.79	2.775
Oct. 16, 1923	23.54	2.775

Conclusion. With 15 fewer furnaces in blast at the end of September than at the beginning of the month because of high stocks, it will not be surprising if pig iron prices fall still lower. Steel, however, seems to be fairly stable at prevailing prices.

Production in Important Industries

Copper and Paper. The index of production of copper (Fig. 4) shows an increase from 319 for July to 329.2 for August, which accounts for the price of $12^3/_4$ cents recently reported in New York. This price is below the cost of production to many of the producers, and there is talk of another great combine in the industry to enable the producers better to regulate production.

The increase of 15 per cent over July in the production of paper of all grades shows some improvement in that industry.

Wool and Cotton. Wool consumption was 4.3 per cent greater during August than during July. The consumption of raw cotton by cotton textile mills decreased in September, the decline being 2 per cent from the August figure. In view of the strained condition in the industry this is not a bad showing. The number of active spindles on September 30, was slightly greater than at the end of the preceding month.

Fuel and Power

Coal. The index for bituminous coal production shown in Fig. 5 stands at 125.5 after correction for seasonal variation. The actual output in September was lower than that for August, and the decrease was greater than normal.

Fuel Oil. The August fuel oil consumption index is 122 as against 133 for July, and as calculations have disclosed no seasonal movement in the consumption of fuel oil, this drop reflects a proportional decrease in activity in the industries using this commodity. The stocks have increased by about 4 per cent, even though production for the month was lower than for July.

Hydroelectric Power. The August power index was 129 as against 134.8 in July, but August is normally slightly lower than July, and therefore most of this drop is normal for this season of the year.

Building Activity in September

All indexes of building activity show a decrease for September as compared with August. Fig. 6 indicates that the value of contracts awarded as reported by F. W. Dodge Company show a large decrease from the August level. Bradstreet's index of value of building permits was 11.4 per cent below August.

Contemplated Construction. The downward trend in contemplated construction was continued throughout September. Our index for August was 112.8 and for September 86.1, a decline of 23.7 per cent. Some of this decline is seasonal and while no accurate calculation of the seasonal variation of this item can be made, it is estimated that September is normally only about 7 to 10 per cent below August.

Contracts Awarded. The September index of total contracts awarded is 97.9 as compared with 134.4 for August, a decrease of 27.3 per cent. Business and industrial building, however, show a decline of only 4.5 per cent. Undoubtedly some of this decrease is seasonal, but these indexes show that practically all of the decrease was in buildings for purposes other than business or industrial, probably being largest in the construction of residences.

Conclusion. The slump in building activity continued during September, and has been a material factor in the reduced demand for certain products such as iron and steel. The several indexes are now below the level of last year, and the decline in permits and contemplated construction indicates that no immediate increase is in sight.

Building material prices are high and show little signs of recession. In fact, higher prices in some lines are likely to come about unless decreased activity forces down the market. Wages in the building trades are also high and recent increases are one factor in keeping building activity down. Probably the housing shortage accounted for the rather remarkable building development in homes during the spring, and the recovery of some business from the 1920 depression had something to do with the increase in industrial construction work which reached a peak in May. But contemplated construction and floor space has fallen to low levels now and shows no signs of prompt recovery.

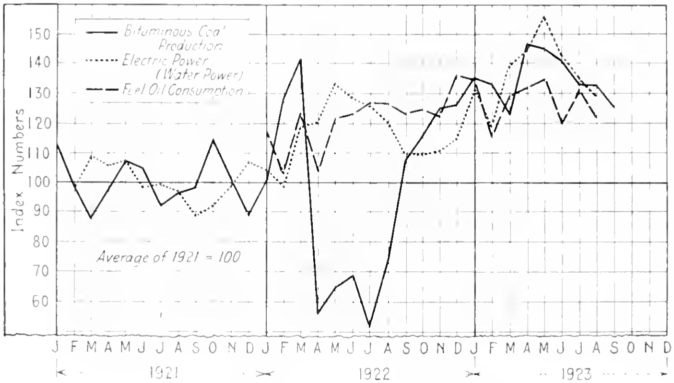
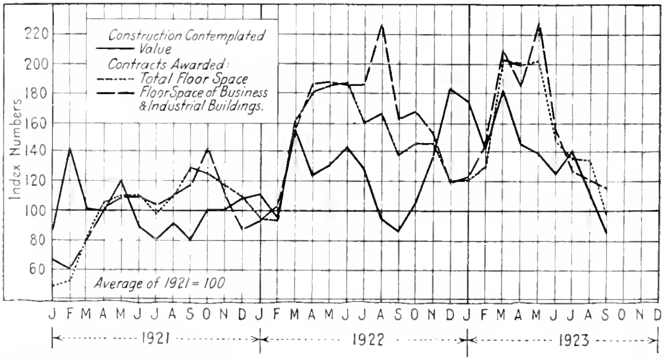


FIG. 5 FUEL AND POWER CONSUMPTION



Source, F. W. Dodge Company

FIG. 6 CONTEMPLATED CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

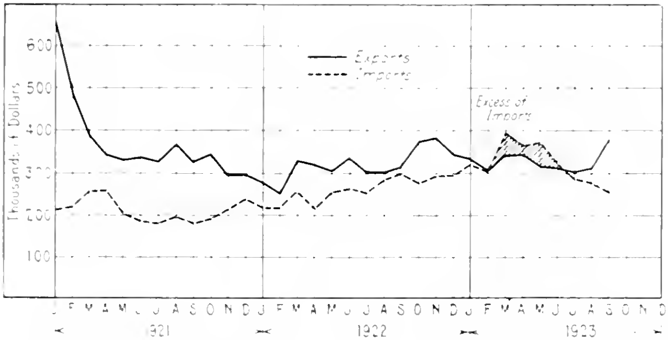
Trend of Trade and Finance

Trade Increasing: Money Situation Strong

Exports and Imports

In Fig. 7 it appears that imports for September ($255,000,000, a decrease of 7 per cent from the August total) were smaller than for any previous month this year. On the other hand, exports during the month amounted to $381,000,000, the largest monthly figure so far this year. This is a gain of 21 per cent over August.

The excess of exports over imports for the month is $126,000,000, and results in converting the unfavorable balance for the first eight months of 1923 into a net favorable balance of $36,000,000.



Source, U. S. Department of Commerce

FIG. 7 FOREIGN TRADE OF THE UNITED STATES

New York Stock Exchange

On the whole the New York Stock Market as shown in Fig. 8 shows some slight improvement. There has been a tendency to greater volume of trading and there is some indication of less activity in following declines. The average price of 50 stocks has failed to break through the low point made toward the end of July. It seems logical to expect that the stock market will soon reflect the improved outlook for business. It has apparently discounted the existing recession in business and industry.

At the end of the period in question (October 16 and 17) there was an ominous weakness in the stock market coupled with a small turnover which indicates that the uncertainties of the future still weigh heavily on the market. But it may be confidently expected that as soon as the favorable development pointed out in these pages becomes generally apparent, the market will grow stronger.

Bank Debits and Postal Receipts

Bank Debits. The index of the average of weekly debits to individual accounts reported by nearly 250 centers (Fig. 9), after allowance for seasonal movement, is 114.5 for the month of September, against 111.7 in August. This is the first upward movement of the index since February. The weekly average in September was more than 9 per cent greater than in August, and about 3 per cent above September of last year. Debits for the first week in October were slightly above the same week last year. Apparently business is now on the increase; at least the decline has been checked.

Postal Receipts. Postal receipts for 50 selected cities during September gained nearly 3 per cent over August. While this is less than the normal seasonal gain for September, it may still [illegible]

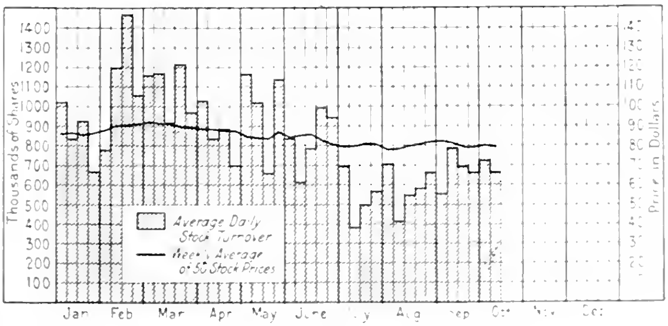
[illegible] the increase [illegible] of the index of bank debits, and the good showing made by postal receipts in spite of the handicaps mentioned above, while they cannot be regarded as indicating definitely increased activity ahead, are favorable signs. At least they show a checking of the declining volume of business which has characterized recent months.

Retail Trade

Mail Order Sales. September mail order sales (Montgomery Ward and Sears-Roebuck), as shown in Fig. 10, were $26,052,649, a gain of 16.6 per cent over August and of 21.3 per cent over September of last year. The September sales were the highest since May and exceeded any September since and including 1920. The month of September normally registers a seasonal gain in mail order sales, but the high figure of last month was not all due to seasonal influences. (On the other hand, a part of the increase in mail order sales may merely represent the normal growth of the business, and consequently may not indicate any cyclical upswing.)

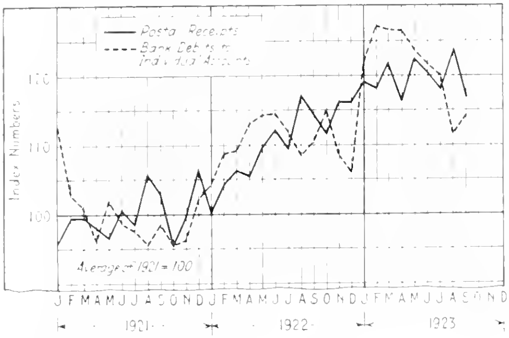
Department Store Sales. Department store sales, as reported by federal reserve banks, gained in August. So far this year they have exceeded sales for the same period in each of the previous four years.

Chain Store Sales. Each of the four chain store systems included in our index showed a decrease in sales for September. However, after correcting for seasonal movement, the activity in September was only slightly less than that of August, in spite of the fewer business days in September.



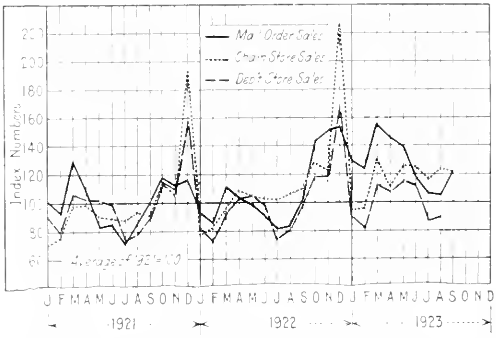
Source, New York Times

FIG. 8 STOCK TURNOVER AND PRICES ON NEW YORK STOCK EXCHANGE FOR 1923



Sources, Federal Reserve Board; Post Office Dep't.

FIG. 9 BANK DEBITS AND POSTAL RECEIPTS
Both curves corrected for seasonal variations.



Sources, Commercial and Financial Chronicle; Federal Reserve Board

FIG. 10 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES
2 Mail order houses; 4 chain stores; 306 department stores.

Conclusion. Retail trade, as measured by the three indexes, has been holding up well this fall. It is expected that the 1923 totals will surpass those for 1922 and 1921, and that they will compare in magnitude with the figures for the post-war years of 1920 and 1919. The gain in Chicago mail order sales may, to a small extent, reflect the stronger price situation as to grain, though this point may easily be overworked.

Wholesale Groceries. The Bureau finds that during September the sales of New York state wholesale grocers fail to show the usual seasonal gain. In other words, an adjusted index of grocery sales registers a decrease. This was in spite of the fact that the average price of wholesale groceries increased slightly. As the sales of wholesale groceries are a good index of business conditions, this may be taken as another indication of the existing downward trend in the cycle.

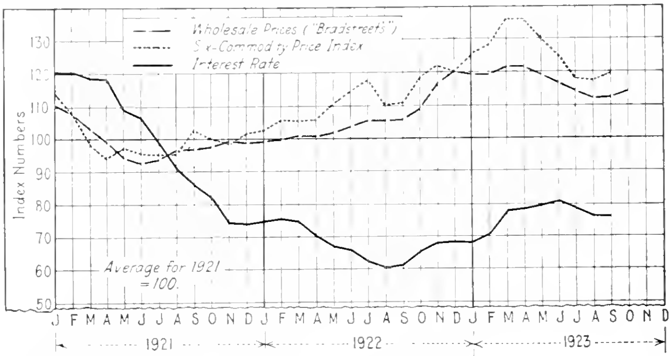
Prices and Interest Rate

Prices. The price curves in Fig. 11 show a general upward trend for September. Bradstreet's price index rose 1.3 per cent. The Bureau's six-commodity price index which averaged 117.5 for August advanced to 119.6 in September. The price advances occurred in breadstuffs, provisions, fruits, textiles, and metals. Declines occurred in live stock, hides and leather, and oils. The advance in textiles was chiefly due to higher prices for raw cotton and silk. Developments during October make a less favorable showing for metals.

The United States Bureau of Labor index of prices shows the following results:

Of the 404 commodities or series of quotations for which comparable data for August and September were collected, increases were shown in 145 instances and decreases in 85 instances. In 174 instances no change in price was reported.

Table 3 shows the index numbers of wholesale prices, by groups of commodities, for September 1922, and for August and September 1923, based on the average of 1913 = 100.



Sources, Commercial and Financial Chronicle, Federal Reserve Board

FIG. 11 WHOLESALE PRICES AND INTEREST RATE
Interest rate is the monthly average, corrected for seasonal variation.

TABLE 3. INDEX NUMBERS OF WHOLESALE PRICES
Arranged by Groups of Commodities
Average for 1913 = 100

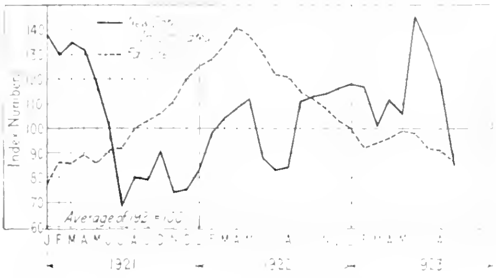
Group	1922	1923	
	Sept.	Aug.	Sept.
Farm products	133	139	144
Foods	138	142	147
Cloths and clothing	183	193	202
Fuel and lighting	244	178	176
Metals and metal products	134	145	144
Building materials	180	186	182
Chemicals and drugs	124	127	128
House-furnishing goods	173	183	183
Miscellaneous	116	120	121
All commodities	153	150	154

Comparing prices in September with those of a year ago, as measured by changes in the index numbers, it appears that the rise in general price levels has been a trifle over one-half of one per cent. While fuel and lighting decreased during the twelve months by 28 per cent, increases occurred in all the other commodity groups, ranging from 1 per cent in building materials to almost $10\frac{1}{2}$ per cent in cloths and clothing.

Interest Rate. The index of interest rates declined after adjustment for seasonal variation. The rate of prime commercial paper remained unchanged at $5\frac{1}{4}$ per cent, while normally there should be a small advance at this time.

Failures and New Business Enterprises

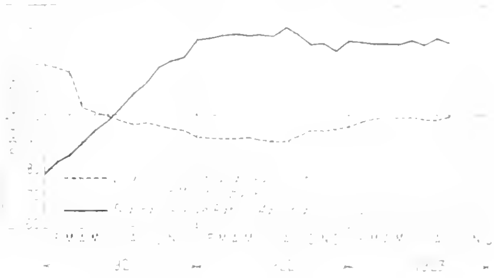
The most significant fact shown by Fig. 12 is the continued decline in the number of business failures. With seasonal variation eliminated the failure curve in September was lower than in any month this year. The curve of new business enterprises, however, which is based on a three-months' average at-



Sources, Dun's Review; N. Y. Journal of Commerce

FIG. 12 BUSINESS FAILURES AND NEW ENTERPRISES

Adjusted for seasonal variation; 3 months moving average.



Source, Federal Reserve Board

FIG. 13 BANK CREDIT AND FEDERAL RESERVE RATIO

Federal Reserve Ratio is ratio of total reserves to note and deposit liabilities.

tained a very low level, which emphasizes the uncertainty that is affecting business. In September the volume of new enterprises increased and was almost exactly equal to the March figure.

Conclusion. The September gain in new enterprises taken together with the smaller number of business failures, may show some improvement in the industrial outlook. Clearly, business and industry have not yet turned the corner, and continued unsettlement is forecast for the next few months. Business failures are still in excess of normal, and the outlook is for an increase in the failure index during October. It will be noted, however, that when the curve of new enterprises crossed the failure curve in 1921 the latter was rising while now it is falling.

Bank Credits

Loans and Discounts. Total loans and discounts of the 770 reporting member banks of the federal reserve system (Fig. 13) were $11,877,005 on September 26. This is a gain of 1.45 per cent over the previous month, 8 per cent over September last year, and is the highest figure reached since June 1921. For the past seven months loans and discounts have been practically stationary. In this period, September is the only month showing a gain exceeding 1 per cent over the preceding month.

Federal Reserve Ratio. After correcting for seasonal variation, the ratio of reserves to deposit and federal reserve note liabilities combined, fell less than 1 per cent. This small change is probably insignificant in view of the high ratio existing. There has recently, however, been evidence of a growing tendency to resort to rediscounts with the federal reserve system, and it is not impossible that some further reduction in the reserve ratio will take place this fall.

Conclusion. The foregoing facts indicate a slight expansion in business, but one which is not yet sufficient to suggest any material tightening of the money market or inflation in credit.

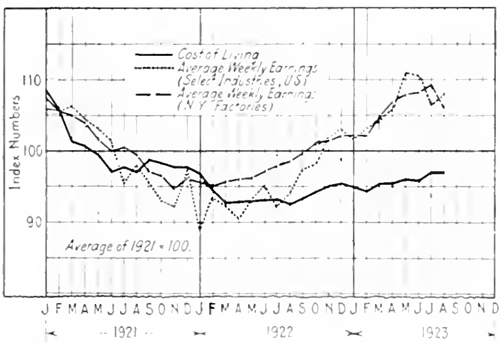
Wage and Employment Situation

Earnings Decline: Labor Demand Lessened

Earnings and Cost of Living

Average weekly earnings (Fig. 14) in New York State factories declined in August instead of increasing as is normal at this period. The adjusted index, therefore, decreased from 109.2 to 105.9, the average of 1921 being 100. This is its first pronounced drop since the low point in the winter of 1921-1922.

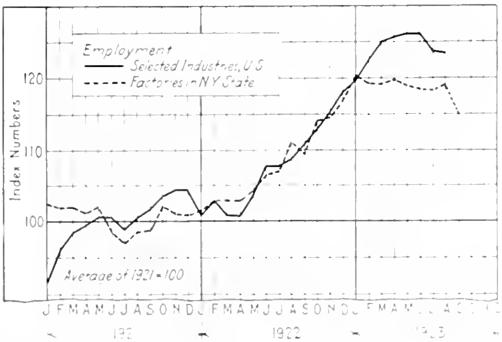
Selected Industries in the United States. The curve of average weekly earnings for selected industries throughout the United States, which is not corrected for seasonal variation, showed a rise from 106.5 to 108.2 in August. A preliminary computation of the seasonal variation in average weekly earnings throughout the United States ap-



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; National Industrial Conference Board

FIG. 14 WAGES AND COST OF LIVING

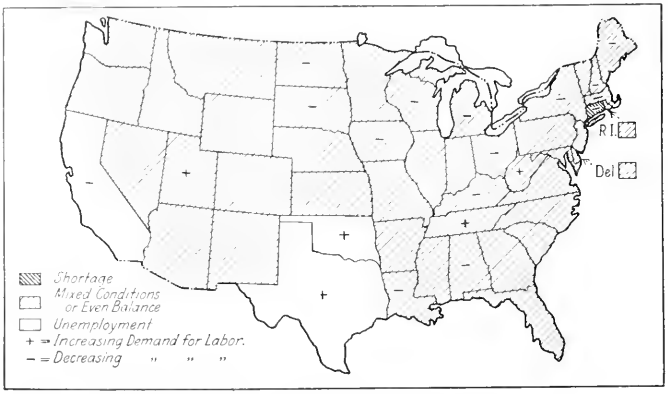
New York factories curve corrected for seasonal variations.



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor

FIG. 15 THE TREND OF EMPLOYMENT

New York curve corrected for seasonal variations.



Source, U. S. Employment Service, U. S. Department of Labor

FIG. 16 CONDITION OF EMPLOYMENT BY STATES, AUGUST 1923

parently indicates that this increase about equals the normal rise for this month.

Cost of Living Unchanged. The cost of living as computed by the National Industrial Conference Board remained unchanged in August. A slight increase in the retail price of clothing was offset by a small decrease in the retail price of food.

Conclusion. Allowing for the fact that the index of average weekly earnings for selected industries in the United States is not corrected for seasonal variation, it is evident from the curves that in the month of August there was some tendency to bring wages more nearly into line with prices. This is a favorable sign for business and industry during the coming months. The failure of the prices of manufactured products to keep pace with rising wages had become quite alarming until recently.

The Employment Trend

As expected the index of employment in New York State factories in September declined sharply after adjustment for seasonal variation. (See Fig. 15.)

Employment Throughout the United States. Data from 6930 representative establishments throughout the United States show that the number of employes remained practically unchanged in September as compared with August. This, however, is virtually a decline; for usually there is a gain in employment in September of about 2 per cent.

Conclusion. While employment continues at a good level, some downward trend is indicated, which is most marked in eastern factories. The Bureau finds that labor's purchasing power was reduced in September.

Employment Map

The employment map for August as

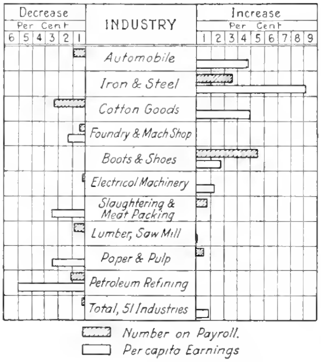


FIG. 17 TREND OF EMPLOYMENT AND EARNINGS, AUGUST 1923

shown in Fig. 16, leads to the following conclusions:

There was great irregularity, with employment increasing in some industries and decreasing in others. No acute shortage existed anywhere, except in a few agricultural districts. In fact, a declining tendency appeared in at least 14 states. There were surpluses of labor in several western states due to the presence of transient laborers and an influx of men from harvest fields. On the whole, the prevalent condition is one of even balance between demand and supply.

Employment in Selected Industries

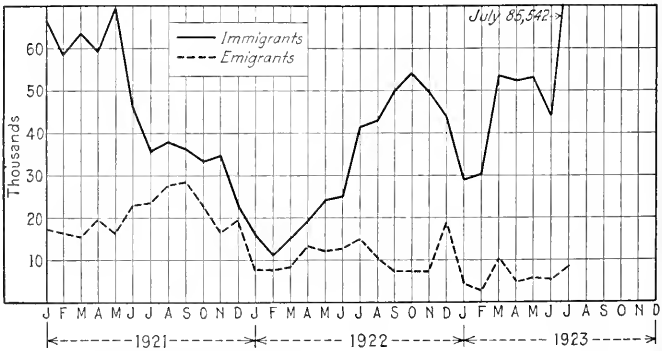
In Fig. 17 is presented a detailed analysis of employment and per capita earnings in the 10 leading industries of the United States.

Employment. Declines in employment occurred in the following industries: electrical machinery; foundry and machine shop products; lumber; automobiles; petroleum refining; and cotton goods. In the latter case, the decrease was 23 per cent; the others were much smaller. On the other hand, there were slight increases in employment in the paper and pulp, and slaughtering and meat-packing industries. Larger increases occurred in the iron and steel industry and boot and shoe manufacture.

Per Capita Earnings. The most notable fact is the large increase of per capita earnings in the iron and steel industries. Increases also occurred in the manufacture of cotton goods, automobiles, boots and shoes, electrical machinery, and lumber saw mills. A large decrease of per capita earnings occurred in petroleum refining. There were also smaller decreases in slaughtering and meat-packing, paper and pulp and foundries.

Immigration and Emigration

The latest figures on migration, Fig. 18, show a net gain of 77,501 in July, the largest month in several years. This has relieved the labor situation in the east.



Source, United States Bureau of Immigration

FIG. 18 IMMIGRATION AND EMIGRATION

NEWS OF EQUIPMENT
FOR THE
MANAGEMENT

The "Ticketograph" Control Board

Class Number
658(004) Management
Control Board

THE Ticketograph method for controlling production has as its basis a production indicator which registers the progress of an order, and coupons printed on a machine which records identical information on a number of coupons with one operation, and is known as the Ticketograph. Referring to the illustration, at the left-hand end of the board or indicator is a space for the control card which gives the order number, quantity, and month or period for which the order is scheduled. The numbers above the tickets correspond with the departments or operations. The production date appears below the pocket for each department or operation. Coupons for the board are produced on the tabulating machine which will make as many duplicates as needed.

As an order is entered in the manufacturing department, to the regular shop order is attached the series of perforated coupons, one for each operation or department through which the work must pass. When the work is started on the job, the starting coupon is removed from the shop order and placed in the "Work Started" pocket of the board. At the end of each operation the coupon covering the work just finished is detached, collected by the production clerk, and inserted in its respective pocket on the board.

An inspection of the board at any time shows the condition of every order in the plant relative to its completion. It forms a graphic guide to departmental operation, both in timing production and preventing overloading or congestion of work.

When production is delayed a red card marked "Production Delayed" is inserted in the pocket referring to that particular order; similarly, a green card indicates Production Advanced, and a blue card reading "Stop Order" prevents any further work being done on a job which has been stopped. This board and the ticketograph printing machine have been developed by the Tabulating Machine Company.

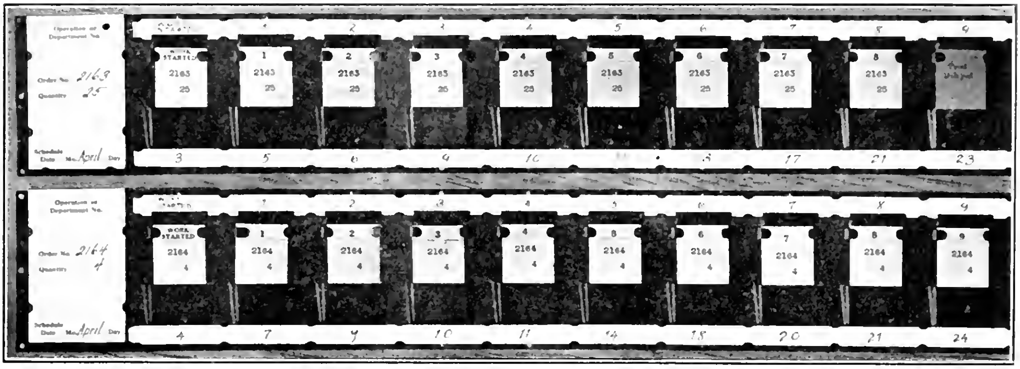


Fig. 1 The Ticketograph Control Board

Compound for Repairing Concrete Floors

Class Number
693.74 Concrete floors

A NEW compound for repairing concrete floors has recently been placed on the market under the name of "Quicktix." It will produce permanent patches in concrete within 48 hr.

The method of application is to chip out the old concrete to a depth of an inch or two, making the edges either straight or slightly undercut. Then broom clean. Soak both the pocket and edges with clear water, remove the surplus, and brush the compound over both surface and edges, following with neat cement. Then apply a mortar mixed as follows:

1 part standard grade cement.
$1\frac{1}{2}$ parts clean, coarse, sharp sand.

Mix to a stiff mortar with water containing Quickfix in the proportion of 8 of water to 1 of the compound. Apply, tamp, float, and trowel in the usual manner. Protect surface and after 18 hr. wet down or cover with damp sawdust or sand. This compound is made by the Master Builders Company.

New Low-Type Electric Lift Truck

Class Number
658.281 Conveying and hoisting apparatus

An electric haulage truck which may be used with the same platforms already employed in connection with hand-lift type trucks, i. e., those which elevate the load by pushing down on the handle, is now offered by the Elwell-Parker Electric Company.

It consists of a hot-riveted steel frame, equipped with an electric motor driving 22 x $3\frac{1}{2}$ in. rubber tired wheels through a worm reduction running in oil. The frame is suspended on springs over this drive axle. A compartment located immediately over the drive axle houses an electric storage battery of either the alkaline or lead type. The motor will drive the truck with a load up a 10 per cent incline.

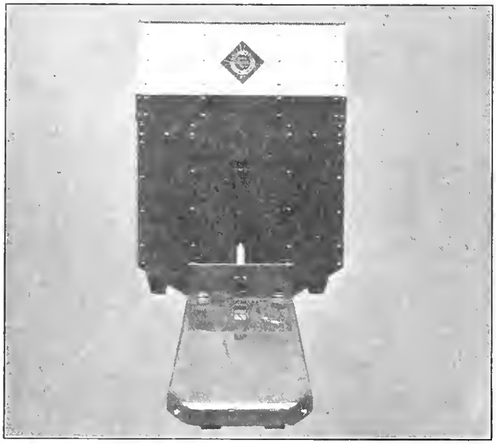


FIG. 1 A NEW ELECTRIC HAULAGE TRUCK

The platform is raised or lowered by rocking and lifting simultaneously. The loaded skid is moved slightly toward the operator and clears any obstruction located beyond the load which might interfere with its elevation.

The load is lifted by means of an arm or screw ram attached to the rear of this rocking platform between two of the supporting links. The other end of the ram is drawn into a threaded nut which is in fact the hub of a bronze worm wheel, which in turn is driven by a steel worm directly splined to the armature shaft of a second motor which receives power from the battery.

To pick up a loaded skid, the operator drives the narrow truck platform of his truck beneath it, closes an electric switch, whereupon the motor actuates the mechanism which lifts the load $3\frac{1}{2}$ ins. in 10 seconds, stopping automatically when it has reached full height. The platform may, however, be stopped manually at any intermediate point.

This truck is intended primarily to extend the hand-lift system. It may be used, however, to carry a load and at the same time trail a load on a hand-lift truck. It will carry a 4000 lb. load at the speed of 300 to 400 ft. per min., which is some 24 times faster than hand-trucking.

Industrial Trucks and Tractors

Class Number
658.281 Industrial trucks

Two models of the new line of industrial trucks and tractors known as the "K" Series are shown in the illustrations. The first is Model K-20, a general utility truck; the second is Model K-22, an elevating platform truck.

In the series are two other models, namely, K-23, a low platform truck, and K-24, a general utility tractor-truck. These are in addition to the regular line of trucks of the Yale & Towne Manufacturing Company.

Each model of this line has been designed with the purpose of a minimum number of parts, maximum accessibility, and the grouping of self-contained major units of the mechanism. The spur-gear unit power axle used throughout is interchangeable with that in all the trucks of the K Series. The control is another subassembly, interchangeable throughout the K series except in the K-24 three-wheel tractor.

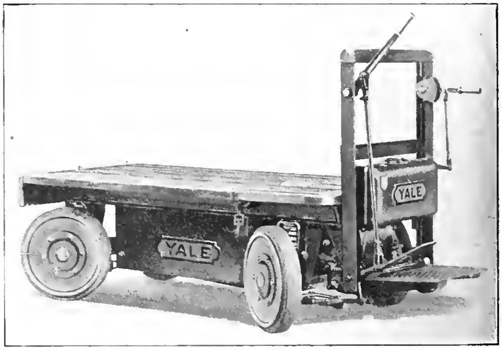


FIG. 1 MODEL K-20, A GENERAL UTILITY TRUCK

The general utility truck, Model K-20 is intended for the general intraplant movement of material. It has a narrow high platform, 38 in. wide, 4-wheel steer, and capacity of 4000 lb.

The elevating platform truck, Model K-22, is a self-loading transportation unit, which can be applied to both high and low lifting. It can be used to lift loaded skids from the floor, transport them to a given place, raise them for stacking or tiering in storeroom or freight car, or brigade them along the floor, as desired. It has a capacity of 4000 lb.

The low platform Model K-23 is a general utility truck for shops and factories where loads of a miscellaneous character must be moved. The low platform, because of the short lift, is adapted to receive heavy loads, piled either by hand or crane equipment. The platform is 38 in. wide, the truck has a four-wheel steer, and a capacity of 4000 lb.

The three-wheel tractor-truck, Model K 24 is a low carrying truck for service in congested places. Its platform area is 15 sq. ft., which is 70 per cent of that of the low carrying truck, Model K 20. It can pass through a 3-ft. doorway or on a 7-ft. elevator. As a tractor it has a normal draw bar pull of 300 lb., a maximum of 1800 lb. As a carrying truck it has a capacity of 4000 lb.

CONDITIONS	SPEED IN MILES PER HOUR			
	Model K-20	Model K-22	Model K-23	Model K-24
Running empty on level concrete	$8\frac{1}{2}$	8	8	$8\frac{1}{2}$
Loaded 4000 level concrete.	$6\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{1}{4}$	
Pulling 4 loaded trailers, 16,000 lb on level concrete..				$4\frac{1}{2}$
Ten per cent grade, 4000 lb. load	2	$2\frac{1}{2}$	2	
Ten per cent grade, 4 loaded trailers, 16,000 lb	..			2

The speed characteristics are given in the accompanying table, to which should be added the acceleration factor, which is up to full speed in a distance of 60 ft. with a full load.

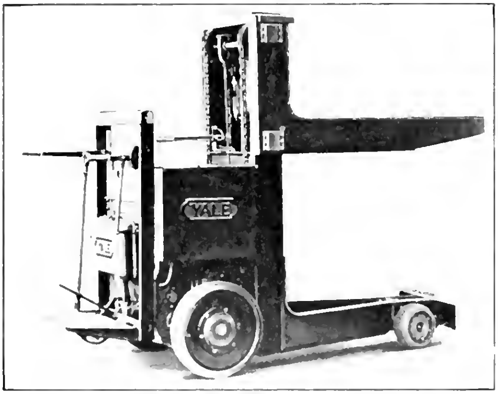


FIG. 2 MODEL K 22, AN ELEVATING PLATFORM TRUCK

A Centrifugal Ventilating Fan

Class Number
621.63 Centrifugal fans

INTERCHANGEABILITY of parts, a self-contained bearing support, and a system of rivetless construction for fan housings are features in the Type-H Ventilating Fan newly developed by the Buffalo Forge Company. The purpose has been to produce a flexible and convenient design. The blast wheel is overhung giving an unobstructed inlet and placing the bearings where they can be conveniently reached. The direction of discharge may be reversed by swiveling the housing. The shaft is extended beyond the outer bearing to receive the pulley, thus permitting a change of pulleys with ease. The bearings have renewable bronze bushings and are mounted as a unit to avoid misalignment.

The reversible feature is made possible by three easily assembled parts. The fan housing consists of two demountable side plates and the shell. To change the hand of the fan it is only necessary to remove the assembly bolts fastening the standards of the shell, shift the cover plates thus reversing the position of

FIG. 1 TYPE-H VENTILATING FAN

the inlet and pulley, and rebolt. To change the direction of the discharge it is only necessary to loosen the assembly bolts and the ring on each side plate, take out the reinforcing bolts, and revolve the housing until the discharge points in the desired direction.

These fans are built in sizes up to and including No. 6, for capacities up to about 14,000 cu. ft. of air per minute.

Easy Reading Mercury Thermometers

Class Number
536.51 Thermometers

A NEW method of tube construction for industrial mercury thermometers known as the TAG-Hespe Red Reading Column, has been adopted by the C. J. Tagliabue Manufacturing Company. The feature is a broad red line behind the mercury column and running to the top of the tube. As the mercury rises it covers more of this red line; as the mercury falls a longer section of the red line is made visible.

In reading this thermometer the eye at first glance sees the red line and follows down until the top of the mercury column is reached when the reading is taken. The sharp contrast in color between the mercury and red background makes possible more accurate reading.

New Automatic and Hand-feed Stokers

Class Number
621.1841 Stokers

A NEW mechanical stoker for any kind or type of boiler from 100 hp. upward and burning all grades of bituminous coal and lignite is announced by the McClave-Brooks Company. This stoker is a combination of the overfeed and underfeed

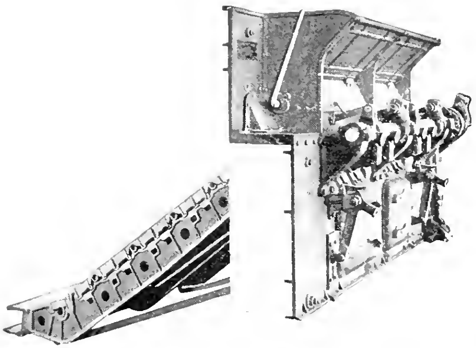


FIG. 1 OPERATING MECHANISM OF STOKER

types. Coal is fed in on top of the grates, yet the method of feeding is such that the fire is completely underfed for a distance of about 2 ft. down the grates.

The stoker is equipped with sectional-top grates having horizontal air space, designed to prevent sifting of fine unburned fuel. The kicker bars are so arranged that in operating there is a complete seal on the heel as well as on the front end of each bar. The kicking

FIG. 2 INTERIOR VIEW SHOWING GRATES AND PUSHERS

movement is automatically controlled, and any kicking position from minimum to maximum can be obtained by a simple adjustment on the front operating shaft. It is also possible to operate the bars in sections.

The coal-pushers or feeders are operated mechanically, and the length of stroke is kept constant. The interval between feedings is regulated by a specially designed timer. Coal is fed to cover the entire grate surface, giving little chance for the formation of clinker. A special pre-heated air arch is used, supplying the requisite amount of oxygen to drive off the volatile gases and eliminate smoke. The front doors can be raised for inspecting or working the fire. Large ash doors give easy access to the ash pit.

The stoker is driven by an independently controlled steam engine, steam turbine or electric motor, and is equipped with a four-speed gear reduction. It can be hand operated in case of emergency. A clutch disengages the power drive and converts the stoker into a hopper-feed hand stoker in a few seconds.

The makers claim that the stoker will operate at 350 per cent of rating without undue strain on the mechanism, and when run as a hopper-feed hand stoker, has maintained ratings of 175 to 200 per cent.

The same company also announces the completion of a hopper-feed hand stoker for use in plants where the small number or size of boiler makes mechanical stokers unnecessary. It burns all grades of bituminous fuel, screenings, slack, coke, and lignite.

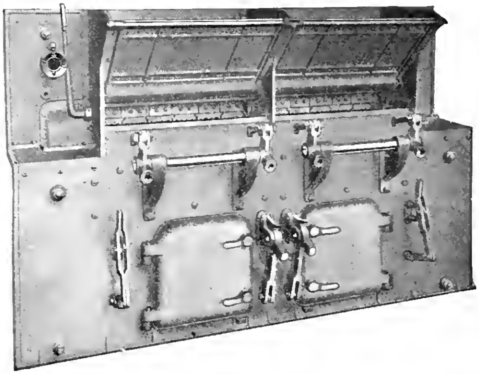


FIG. 3 EXTERIOR VIEW OF HAND-FEED STOKER

This stoker is equipped with pre-heated air arch, coal feeders, kicker bars and McClave sectional-top hand stoker grates, with the addition of special horizontal-mesh coking plates used in the coking area in front of the grates. It is guaranteed by the maker to comply with the anti-smoke laws of any municipality.

Gas Conditioning Devices for CO2 Recorders

Class Number
662.621 Carbon dioxide recorders

THE three devices illustrated have been designed to eliminate soot, moisture, and sulphur and to prevent fouling and corrosion of CO_2 analysis equipment and the tubing which conveys the gas sample to the instrument. These are known as "Pyro-Porous" gas filter, dryer, and purifier.

In use the filter is placed in the direct path of the hot flue gases on the extreme end of the gas sampling line Filtration is accomplished by two porous refractory discs, which may remain in continuous service for months without being replaced or offering increased resistance to the gas flow. The discs are held in a special casting by means of a bolt. Discs and bolt washers seat on asbestos gaskets or washers.

The gas dryer is designed to remove moisture from the gas, thus preventing forming of water pockets at low points of the line which might interfere with the gas flow. The gas enters at the bottom of the dryer and passes upward through the charge of calcium chloride, which lasts from two to eight weeks depending upon local conditions.

The dryer cap is readily removed for filling by loosening three wing nuts. The base is also readily taken off for washing out sediment. Both are made tight by rubber rings. A coarse wire screen prevents the unused calcium from falling into the drain outlet.

The gas purifier has been developed to remove sulphuric acid fog, one of the most harmful impurities in flue gas. The flowing gas is passed through a porous thimble upon which the acid fog is deposited. This sulphuric acid deposit may be washed off periodically, say every three or four weeks.

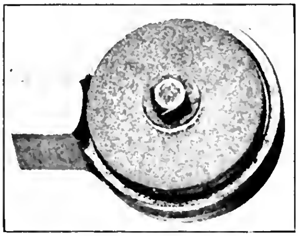


FIG. 1 FLUE GAS FILTER

Beside eliminating sulphur, the purifier acts as a 100 per cent emergency filter which might be called upon at some time to protect the line and CO_2 meter from soot deposits should a filtering disc of the preliminary "Pyro-porus" filter become accidentally broken.

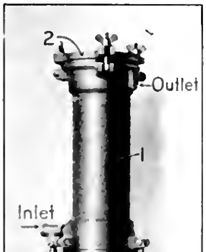


FIG. 2 GAS DRYER

The purifier also furnishes the necessary resistance to the gas flow which, with the system in use, insures a constant suction of 6 inches of water head for the gas entering the CO_2 meter, regardless of any change in draft conditions.

These devices have been developed by the Uehling Instrument Company.

Many CO_2 recorders in use have not given satisfactory service, due partly to neglect on the part of the operator, who perhaps, has not been thoroughly informed about the device, and also due to the presence of soot, moisture, and sulphur gas which put the instrument out of commission. The three pieces of equipment described here serve to eliminate practically all but the human equation.

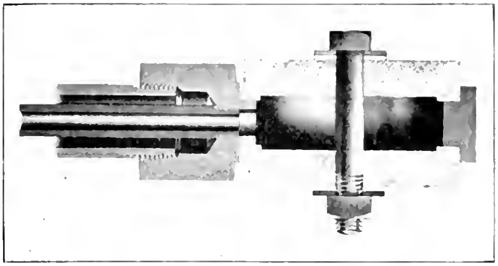


FIG. 3 CROSS SECTION OF FILTER IN FIG. 1

Small Air Motor Hoist

Class Number
621.86 Hoists

AN air motor hoist of 500 lb. capacity, a smaller size than has hitherto been manufactured, is now available from the Ingersoll-Rand Company.

The outstanding characteristics are: Compactness of design resulting in low head room required; relatively light weight; automatic brake which positively holds the load under all circumstances—even if the air supply be disconnected or fail; and a graduated throttle which permits a close regulation of both lifting and lowering speeds.

A balanced three-cylinder air motor is used which operates without vibration in either direction at any speed or load within the rated capacity of the machine. The motor is used in other Ingersoll-Rand Hoists.

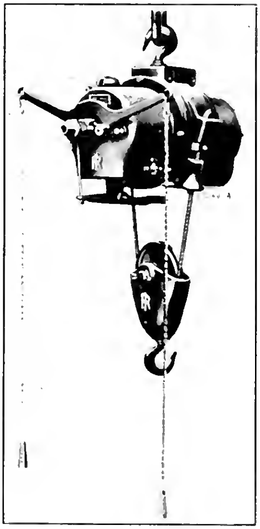


FIG. 1 AIR MOTOR HOIST

The throttle graduation is very fine, insuring instant and complete control of the hoist at any speed. A safety stop lever closes the throttle and stops the motor whenever the load is raised to the top.

The automatic brake which holds the load at any desired position for any length of time regardless of air pressure consists of a disc attached to the motor shaft, and a brake plunger with a friction face, held in contact with the disc by springs whenever the hoist is not operating, i.e., whenever the air is cut off.

Both motor and gears are enclosed; the motor operates in a bath of oil and the gears turn in a heavy grease.

The essential details are as follows: Size, A; capacity, 500 lb.; feet lift per min. (80 lb. air pressure), 50; maximum lift, 15 ft.; size and length wire rope, 1/4 in. x 35 ft.; net weight, 150 lb.; air pressures, 60 to 100 lb.

A Slide Rule for Standard Parts

Class Number
621.81(083) Machine parts.
Calculations

THERE has recently been put on the market in Switzerland a slide rule for finding the dimensions of standard parts. It is applicable to all lines of manufacture where a range of sizes is made and where all the dimensions for each specific size have definite relations to each other.

The slide rule consists of two parts, a body and a slide. The former is a piece of lightweight, gray bristol board doubled over and glued together at the top to form an envelope for the slide. The slide is of heavy India tinted stock. It is shown protruding at the right in the illustration.

On the body is printed a cut of a bolt with washer, nut, cotter pin hole, thread outline, a cross-sectional view and a drill. Each of the dimensions required to draw this bolt is indicated by the usual dimension lines and in most cases by a letter. Where the actual values appear in the accompanying picture there are rectangular holes cut in the body of the rule through which are read the numbers, the latter being printed on the slide. A few values, such as the 55 deg. thread angle, are standard for all bolts of this design and these are printed on the body itself.

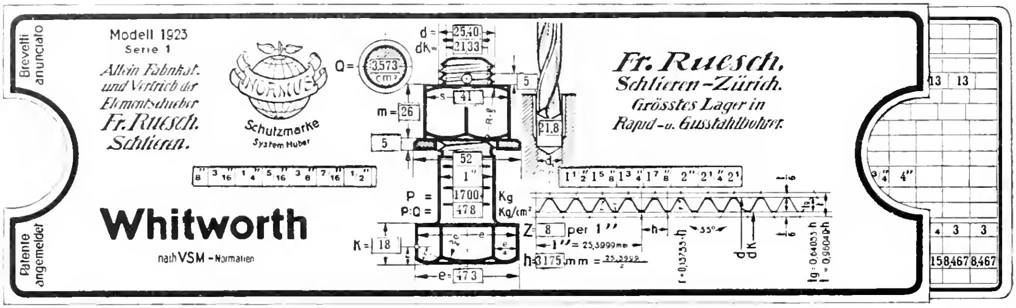


FIG. 1 GRAPHIC SLIDE RULE FOR OBTAINING DIMENSIONS OF STANDARD PARTS (FRONT SIDE)

Bolt sizes are all based on the bolt body diameter as the fundamental measure. Hence, by moving the slide until the desired diameter (1 in. in the picture) appears in the body diameter rectangle, all the sizes (in metric units, the European standard) of the other parts of the bolt show up in their proper rectangles within the dimension lines where they would come on a drawing. Washer sizes and cotter pin hole are given. The root cross-sectional area, Q, the correct drill size, D, the safe load, P, the unit stress $\frac{P}{Q}$, the number of threads per in., Z, and the pitch, h, all move into their proper rectangles.

Bolt diameters are printed in red, and everything else in black. To the right and left are seen long rectangles through which appear on the slide the series of sizes in which these bolts are made, namely 1/8 in. to 4 in. It is these values set in the proper location (where 1 in. is in the illustration) that at once determine all the others appearing at the same time in the rectangles for the remaining dimensions of the bolt.

The slide rule is, therefore, the equivalent of a complete table of dimensions for standard bolts. Errors frequently made in reading a table by taking values from the wrong line or column of figures, are avoided by using the rule. Once set, the rule hides all but the correct set of values showing up in their proper rectangles. In addition, the time saved in finding dimensions is considerable.

On the reverse side of the rule similar cuts are printed for keys and keyways and for gas pipe. For keys the main setting dimension is the diameter of the shaft, and this is given between limits (thus, 50/58) because one size of key will do for more than one diameter of shaft. The height and depth of key, and depth of shaft keyway, show up in their proper rectangles, and dimensions indicating the hub keyway for keys, either with or without top clearance, appear in respective openings.

For gas pipe the leading dimension is the inside diameter. When set thus for any size (given in both in. and mm.) the corresponding outside and root diameters of thread, the number of threads per in., and the outside diameter of the unthreaded portion, move into the correct rectangles. To one side is a drawing of a weighing scale with a one meter length of gas pipe shown lying on the platform. The corresponding weight appears in a rectangle cut in the slide rule body as part of the counterbalancing weight picture.

The whole series of fundamental diameters for each of the two items shows on the slide through openings in the body to the right and left of the drawings of the objects. Instead of the three articles used in this instance, any standard parts can be substituted with equal facility. If the rule is to be used very much it can probably be made of opaque celluloid instead of bristol board. It will then have longer life. As the device does not depend upon exact settings for its readings, any wear to which it may be subject will not impair its usefulness.

The device is practical and the American Engineering Standards Committee, whose secretary brought samples back from the international convention at Zürich, reports that the maker sold 5000 in one month.

CURRENT BOOK REVIEWS

A Manual for Factory Managers

PRACTICAL FACTORY ADMINISTRATION. *By Matthew Porosky. 244 pp. McGraw-Hill Book Company, Inc.*

REVIEWED BY JOHN DEC. VAN ETTEN
Factory Manager, Holtzer-Cabot Electric Company

Class Number
658 Factory Administration

IN this volume the chairman of the factory management committee of The Holtzer-Cabot Electric Company attempts to cover a rather wide field, but it must be conceded that he achieves a fair degree of success.

There has been during the last 10 years, as Mr. Porosky indicates at the beginning of his book, a marked change in the methods employed in managing industrial establishments. This has been brought about by the phenomenal growth of industry, the keenness of competition, and an increasing recognition of the interests and rights of the operatives.

Management, the author submits, now shows a fuller appreciation of its duties and responsibilities toward capital, labor, and the public. Modern industry has become an institution with an enormous and far-reaching influence, and with almost unlimited opportunities for service. It has become an intimate part of our social structure upon which the worker depends not only for his livelihood but also for his personal well-being and improvement.

The book attempts to present the accepted principles of modern factory administration, and to show how they may be effectively applied to actual operating conditions. It is addressed to executives, salesmen, foremen, cost accountants, and students of factory and business administration in schools and business establishments. Its appeal to the last-named class is considerably strengthened by Mr. Porosky's connection as instructor in factory administration at the Northeastern University School of Commerce and Finance.

The order of presentation is clear-cut and logical. After preparing the general background by indicating the various forms of industrial organization, the author provides a chapter on buildings and equipment and then takes up the planning of the product, the handling of materials, inventory records, and production control.

The personnel element comes out strongly in Chapters VII, VIII, and IX, under the headings "Labor Management," "The Foreman," and "Wages and Incentives." The tenth chapter is concerned with cost accounting; the eleventh, on the planning department, ties back to Chapter III on "Planning the Product;" and the final chapter, "Synchronizing Sales and Production," takes up the problems common to both sales and factory departments, such as factory and sales requirements, causes for complaints, poor service, the getting out of samples and other factors contributing to good-will.

The book is well illustrated with charts, diagrams and particularly with sample forms. Chapter V on "Inventory Records," for example, gives suggested form for stock record cards for both hand and machine posting, inventory test report, inventory tally sheet, delivery ticket and sheet, production order, additional material requisition, bin tag and record for determining limits and ordering quantities. Chapter X on "The Cost Department" shows forms for a piece-work time-card, job time-card, overtime ticket, piece-work credit slip, summary of costs and excessive cost report.

Mr. Porosky strongly favors the "one-two-three-four" style of composition, which seems to be particularly effective in a book of this type. He restrains himself on Page 1, but offers this on Page 2:

> In starting any manufacturing enterprise it is necessary to know:
>
> 1. What you are going to manufacture.
> 2. Where you are going to manufacture.
> 3. What buildings and equipment are necessary.
> 4. What organization is necessary for accomplishing the desired end.

On Page 3 there is another suggestion, in 8 parts:

> The organization must define or provide for:
>
> 1. The line of authority which involves co-ordination of effort.
> 2. Responsibility which means control.
> 3. Division of labor in order to avoid confusion and secure the benefits of expert service.
> 4. A system which assigns authority and responsibility.
> 5. Discipline which maintains organization.
> 6. Successful planning.
> 7. The keeping of records and statistics.
> 8. The promotion of teamwork.

This book is of value to executives in small plants, as well as in large, because the principles, practices, and forms outlined therein are presented from the viewpoint of the average rather than the exceptionally large establishment. Factory managers and others interested in industrial organization will do well to add it to their desk or library equipment.

Safeguarding Invested Capital

THE ART OF INVESTMENT. *By Morrell W. Gaines. 231 pp. The Ronald Press Company.*

REVIEWED BY RODNEY HITT
Of Hitt, Farwell and Company

Class Number
332 Investment

THE old theory of investment, unfortunately now almost extinct, was to put money capital at work with the sole idea of maintaining intact the principal of the investment and obtaining as large an annual income as possible consistent with safety of both principal and interest. The modern theory of investment is to put capital to work in return for an annual interest income, but always having in mind the possibility of appreciation in the value of the principal. This newer theory of investment, after all, is only a dignified form of speculation, where one endeavors to limit the possibility of heavy losses without limiting the profits.

The extraordinary fluctuations of the security markets during the last 10 years of the war period and the post-war period have had much to do with the development and encouragement of this modern idea of investment. Many investors who would shun the appellation of speculator have been buying bonds on margin and dabbling in stocks, firm in the belief that they were not speculating, but investing. Needless to say, most of them have lost more in principal than they have gained in income, because they have followed no consistent policy of buying and selling. "The Art of Investment" is a good guide for those who prefer the modern theory of investment to the old-fashioned one.

The author of this book is an economist and financial analyst, and the book is written largely from the viewpoint of a mind trained in reaching conclusions from statistical data. A substantial part of the book is taken up with a discussion of the reasons why security prices fluctuate, and an exposition of the opportunities to make profits out of these fluctuations through purchases at the low point and sales at the high point. Unfortunately in nine cases out of ten the investor is timid when prices are low and does not buy. On the other hand, he cannot be persuaded to sell his securities when they are high, either because he thinks they are going still higher, or because he does not know what to do with his money, if he sells. The author presents clearly and forcibly the barometric indications of changes in security prices before they occur, the possibilities of changing investments from long-term bonds into high-grade stocks, and the temporary utilization of funds in short-term investments. If an investor has the persistence and the moral courage to follow consistently the theories expounded in this interesting book over a long period of years he should profit thereby.

For the sophisticated or the unsophisticated investor there is one chapter in the book which is worth perhaps more than all the others, and that is the one which deals with the subject of "Dealers in Securities." The investing public has been hoodwinked and defrauded out of so many millions of dollars in the last few years by unscrupulous promoters and alleged dealers in securities that it is little wonder that they doubt the honesty and integrity of any dealer, no matter how reputable he may be, who solicits their business. There are fake dealers in merchandise, but they are easily distinguished from the reputable stores, and only the most ignorant and stupid are deceived. Unfortunately the crooked dealer in securities is not so readily identified among the mass. There are hallmarks of quality among investment dealers, however, which if recognized by all investors, large and small, would save many an unfortunate loss. These hallmarks the author describes and the reader would do well to observe them.

"The Art of Investment" is a book well worth reading, not so much because it gives specific suggestions as to the road to wealth, but because it discusses in a clear and convincing way the principles which must be followed, consciously or unconsciously, in the accumulation and safeguarding of invested capital. It can be read with profit by the beginner and the experienced capitalist.

Functional Theory of Wages

The Control of Wages. *By Walton Hamilton and Stacy May. 185 pp. George H. Doran Company.*

Reviewed by Frank T. Carlton

Professor of Economics, De Pauw University

Class Number
331.2 Wages

For years students of labor problems have clearly discerned that no one of the theories of wages formulated is adequate to explain wage rates in actual practice or to throw sufficient light upon the problem of wage increases. The authors of this volume have consequently attempted pioneer work. The "functional theory of wages" which is presented is not futilely based upon a concept of a natural law of wages. It is a commendable effort tending toward the formulation of general rules for the "control of wages." The authors insist that while wages may be "domesticated," the consummation of such a process will come only "through persistent effort and a long-time program."

> This theory explains wages, so far as it explains them from the standard of the single problem of how they may be raised through a conscious control of the factors upon which they rest. Its claim to a hearing is that this is by far the most important of all the problems with which those who receive wages or bother about wage theory are concerned.

The authors do not paint Utopias; they have not prepared a patent medicine for the settlement of wage rates. But, in a comparatively few pages, they present certain very sane suggestions as to general methods of controlling wage rates.

The book under consideration is one which opens the way for further work; but there can no longer be found a legitimate excuse for presenting in an elementary text in economics, except for historical purposes, any one of the familiar and threadbare theories of wages. No student of economics, of the labor problem, or of industrial questions can afford not to read this little volume. It is written in an interesting style. The opening page of every chapter is adorned with a quotation from the famous practical philosopher, Mr. Dooley—surely a startling innovation.

Briefly stated, the authors insist that the rate of wages paid in an industry depends upon a combination of (*a*) the laborer's real wage and (*b*) the "free income" of the worker. This corresponds to an income which the reviewer has designated[1] as real wages in a broad sense. "Free income" consists chiefly of the

[1] Carlton, "History and Problems of Organized Labor," p. 6.

many services performed for the laborer by the state, and certain "devices for easing the strain of the day's work, facilities for recreation, health services, and opportunities for industrial training and general culture" utilized by employing corporations. The laborer's real wage rests upon: (*a*) the nominal rate of wages, which in turn depends upon the state of the "industrial" and "economic" arts, costs for materials, etc., and the incomes which go to the owners and managers, and upon the "ability of wage-earners to discover and to appropriate income in competition with other groups who would possess it;" and (*b*) the purchasing power of money or the price level.

It seems capable of demonstration that scarce factors in production receive high returns. Consequently, in the last analysis, wage rates may depend upon the supply of workers, upon population increase. A land area possessing only scanty natural resources and no extraordinary market opportunities will soon reach the point of diminishing productivity per worker as the population grows. Hamilton and May's thesis seems especially adapted to a country of relatively scanty population which is as yet on the upgrade in regard to per capita output.

In discussing the possibilities of increasing wage rates by concerted and rational methods, it is important that in our enthusiasm we are not led to overlook the population question and the fact that diminishing productivity is not a phantom of the classical economist. It may also be suggested that, until we know more about the problem of incentives, care ought to be taken in any far-sighted program for increasing wages, not to infringe so far upon profits that the incentive for good and increasingly efficient management is inhibited.

For Students and Executives

BANKING AND CREDIT. *By Davis Rich Dewey and Martin Joseph Shugrue. 506 pp. The Ronald Press Company.*

REVIEWED BY JAMES RATTRAY

Assistant Vice-President, Guaranty Company of New York

Class Number
332.1 Banking

ON the title page this book is described as "a textbook for colleges and schools of business administration." There is, however, much in it that those engaged in business could read to advantage. A concise but clear explanation of the means of obtaining credit at a bank, the basis for such credit, and the instruments that are used in connection with it is contained in the chapters on "Commercial Credit Instruments," "Commercial Credit Documents," "Letters of Credit," "Commercial Loans," "Security for Loans," and those dealing with credit statements.

There is also an interesting chapter on "Acceptances," dealing with the use of banker's acceptances and trade acceptances, and discussing briefly their advantages and disadvantages. As acceptances are credit instruments, frequently given upon the passage of title to credit documents, the logical place for this chapter would appear to be following "Commercial Credit Instruments," instead of being segregated near the end of the book.

Three chapters are devoted to foreign exchange, one dealing with the principles of exchange, another with the process of exchange, and the third with typical exchange transactions. Considering the development that has taken place in the export trade of the United States during the last decade, and the important position that this country now occupies in international finance, some knowledge of foreign exchange is essential to many business men. This brief discussion does not, of course, attempt to cover the entire field, but it does give a lucid explanation of the causes of exchange fluctuations and the manner in which foreign exchange transactions are handled. As there are many technical details to be taken care of, exporters and importers usually rely on their bankers for guidance in handling exchange transactions, but it is much easier for the banker to handle such transactions when his customer understands the underlying principles. These chapters on foreign exchange should be of interest to those who have occasion to engage in such transactions.

The chapter on "Negotiability," which summarizes some of the provisions of the Negotiable Instruments Law, is scarcely comprehensive enough to be of the greatest value. Although the Negotiable Instruments Law is almost uniform, there are important differences in many of the states, and there have been so many court decisions on negotiability that it is practically impossible to cover this subject adequately in a few pages.

Various problems in banking and finance with and without solutions are given in an appendix. This is practically an application of the case method of instruction, which is being used successfully, and anyone solving these problems after reading the book would undoubtedly find the effort worth while. Other appendices contain interest tables of various kinds, a table giving the values of foreign coins in terms of the American dollar, and an alphabetical list of references to approximately 80 standard works on banking and kindred subjects, all of which should prove useful.

The introductory chapter, "Money and Credit," and the next chapter, devoted to a discussion of the stock of money in the United States and the various classes of coin and currency which constitute it, resemble the usual chapters that appear on these topics in textbooks on banking and economics. There is a historical account of banking in the United States and a description of the various kinds of banking and credit institutions in this country. Chapters on the balance sheet of a bank, deposits, national bank note circulation, the investments and reserves of commercial banks, the functions of a clearing house, and the organization and operation of the federal reserve system should prove interesting to the student of banking.

There is a chapter on monetary problems which is partly historical and partly a discussion of various economic theories, and another on the New York money market and the course of money rates over a period of years, with some explanation of the causes of their rise and fall. The presentation of the subject matter is somewhat different from the ordinary textbook on banking, and the book contains much that should be of interest to business men.

Successful Co-operative Selling

CO-OPERATIVE MARKETING. *By Herman Steen. 355 pp. The American Farm Bureau Federation.*

REVIEWED BY H. H. MAYNARD

Professor of Business Organization, Ohio State University

Class Number
658.83 Marketing

IT is generally assumed that co-operative marketing of farm products is a new movement. As a matter of fact, however, the volume under consideration shows that co-operative marketing was introduced in Connecticut in 1810 with some success. By 1841, a number of organizations were successfully selling dairy products in Wisconsin and Illinois. The civil war stopped the spread of the movement until it was revived by the granger movement in the seventies. By this time, cheese kings in Wisconsin, fruit associations in New England, livestock shipping associations in Tennessee and Nebraska, and the grain elevators of the West existed in their earlier stages. Development in recent years is indicated by the fact that over $1,000,000,000 of farm products were sold by co-operators in 1922. In the dried fruits, citrous fruits, and tobacco, 75 per cent of the product is so marketed.

Because of the desire of the American Farm Bureau Federation to make the story of this movement available in book form, this volume was prepared. It traces the history of co-operation and shows something of the possibilities inherent in the movement by the discussion of the results obtained in the marketing of about 20 different agricultural products. Methods of organization, finance, and sales are described, and the conditions which modify organization and policy are discussed.

The author has chosen to appeal to the farm readers by the use of rather fanciful chapter titles. For example, he discusses the co-operative marketing of eggs under the chapter heading, "Unscrambling the Egg Market." Others are "The Milky Way," "Shearing the Wool Buyers," "Everybody's Apples Are Best," "Spilling the Beans," etc.

The reviewer feels that the author could have made his book more valuable had he discussed the failures of certain associations. However, he chooses to mention only the successful associations. Had he shown the reasons for failure of certain well-known movements, his book would have been more valuable. One other criticism of content may lie in the fact that in the chapter on marketing apples, the author does not describe or even refer to at least two of the largest and most successful apple associations—organizations which have been pioneers in developing apple marketing co-operation.

The author considers that co-operation is the farmer's answer to the "37-cent dollar." He feels that co-operation through rightly organized and properly managed associations will enable the farmer to secure a larger share of the consumer's dollar for himself. He asserts that marketing through any other type of shipping agencies, such as the cash buyer or a commercial firm, is essentially wasteful, but he gives little argument to support his contention. On the whole, there is a failure to recognize the fact that many farmers are not so mentally and socially constituted as to be good co-operators. They are individually rather than socially minded, and hence do not readily co-operate. This fact will always limit the possibilities of the most extended use of co-operative marketing.

Business executives may read this book with profit and pleasure, for, on the whole, it gives a fair statement of what has been accomplished by co-operative marketing. This movement is important from the viewpoint of manufacturers. If, as is frequently claimed, co-operative marketing will reduce the cost of distributing farm products, such reduction may result in greater buying power on the part of farmers. The larger message of waste elimination is one which affects all business men.

First Aid to Exporters

FOREIGN TRADE ORGANIZATION. *By J. Anton de Haas. 378 pp. The Ronald Press Company.*

REVIEWED BY O. K. DAVIS

Secretary, National Foreign Trade Council

Class Number
382 Foreign Trade

RECENT years have witnessed the publication of excellent textbooks in the English language dealing both with the history of commerce and with the technique of export management. Between these two fields, however, there has remained a gap within which lie a variety of topics of interest and value to the student of foreign trade. To fill in this background is the purpose of Professor de Haas in his latest book, "Foreign Trade Organization," and he brings to his task an international familiarity with trade which is reflected throughout his writings.

The opening chapter on factors in international competition goes at once to the heart of many questions now the subject of political controversy. Comparison is made between marketing problems connected with manufactured products and those connected with raw materials. Both our agricultural producers and tariff makers can learn much from this discussion. Too few people realize that raw materials, being subject to world prices, flow from low price to high price countries; while manufactured products—owing to skill in marketing methods or inherent quality—may flow in the opposite direction, even in the face of tariff legislation.

Chapters follow on the collection of trade statistics, customs formalities, and the methods of governmental trade promotion followed by the principal countries of the world. An unusually detailed discussion of the organization and foreign trade work of chambers of commerce, both in the United States and abroad, is also presented.

The subject of expositions, fairs, exhibits, and commercial museums is then taken up and given more attention than is customary in works of this character. In Europe, at least one important international fair is held in each country, generally attracting a larger number of foreign buyers and resulting in a marked stimulus to business. Heretofore there has been nothing of this kind in the United States, preference being given to more aggressive individual salesmanship. Very possibly there may develop in this country greater interest in such displays; a hint as to their feasibility is afforded by the recent National Merchandise Fair in New York City.

The ensuing chapter on trade promoting agencies differs from previous treatments of this subject in laying special emphasis on the work of news agencies, and in giving a full description of trade promotion organization in countries other than the United States. While much is heard at times as to the inadequacy of American effort in foreign trade promotion, a real knowledge of the work carried on both by our government and by private agencies would seem to indicate no lack in this direction.

Under the heading "Organization of the Raw Material Markets," Professor de Haas has included a detailed description of the European auction system, together with an analysis of different kinds of exchanges, both in Europe and the United States. A supplementary chapter considers the collection of crop estimates, the grading of raw products and their sale and delivery. In discussing the various methods of conducting export sales, analysis is made of advantages and disadvantages of direct selling, co-operative selling, and selling through middlemen.

The chapters dealing with the legal position of the commercial concern at home and abroad are of vital interest. Without going into too great detail, the author describes the forms of commercial organization common in Europe and refers, in passing, to various requirements of foreign commercial law. While other treatises discuss this matter, also the legal status of the commercial traveler, registration of trade-marks, etc., in greater detail, enough is said to indicate the necessity for proper legal advice in the conduct of foreign trade.

As can be realized from the above, this book deals with a wide range of subjects, some of them but distantly related to each other. It serves a useful purpose in supplementing more technical books and in providing outside reading to round out a course in foreign trade management.

Backgrounds of Economic History

Outlines of Economic History in the Nineteenth Century. *By Garrett Droppers. 286 pp. The Ronald Press Company.*

Reviewed by Felix Flügel

Assistant Professor of Economics, University of California

Class Number
330 Economics

Professor Droppers has undertaken the task of giving the student:

> . . . the necessary historical background for the economic period in which he is living by means of a concise survey of the period out of which it grew. Such a survey, obviously, must take to a degree an international viewpoint, inasmuch as the conditions and tendencies governing the economic [illegible] nation [illegible].

The author [illegible] with the express [illegible] general account of the more important [illegible] nineteenth century which may be valuable in [illegible] present day economic tendencies.

Professor Droppers expressly [illegible] in his preface that:

> . . . the aim . . . in these pages [illegible], not so much to present a chronological history of the economic development of any one country, as to take account of the leading facts and forces of the nineteenth century that have influenced the United States, Great Britain, France, and also Germany and Italy.

Accordingly, nearly every chapter of the book forms a separate entity. It appears to the reviewer, however, that many of the chapters might well have been combined, thus securing a gain in unity which would more than compensate for any disturbance of the topical method of treatment.

The opening pages, dealing with "The Commercial World in 1763," form a general background for subsequent chapters. This is followed by a survey of the phenomenal changes in industrial technique toward the end of the eighteenth century. The author then traces practically every important phase of the economic development of England during the first half of the nineteenth century. Less comprehensive is his treatment of the continental European countries and the United States for the same period. The sweeping effects of the industrial revolution which followed long after the first mechanical devices were introduced are likewise considered. Separate chapters are devoted to the question of the adjustment of demand and supply—one of the inevitable problems following a sudden increase in production—to remedial social legislation, to immigration, and to improved methods of distribution.

In another chapter the more important phases of the long and wearisome struggle against trade restriction, which resulted in the gradual liberalization of national economic policies in the nineteenth century, are briefly but well presented. In discussing the events of the second half of the century, Professor Droppers emphasizes the remarkable changes which occurred in the development of the means of communication and the technique of trade and industry in general. Several chapters are devoted to the Franco-Prussian war and its consequences, and to economic crises, the latter unquestionably constituting one of the most interesting phenomena in economic evolution. Not only the history but also the theory of business cycles is briefly touched upon. The final chapter of the volume, on "The Outlook for the United States," gives a conception of the utility of a knowledge of economic history. For the benefit of the general reader this chapter might well have been expanded to include the outlook for the world as a whole. While domestic problems are undoubtedly uppermost in the minds of most persons, it is nevertheless the commercial contacts with the outside world which to a large extent give rise to a nation's prosperity. Altogether too frequently is this fact overlooked.

A PLATFORM FOR INDUSTRIAL PEACE. *16 pp. The Crowell Publishing Company.*

IN the 10 planks of this platform, built by the readers of Collier's, there is presented a plan for preventing strikes which the sponsors believe offers common ground on which all fair-minded employers and workers can meet.

In an editorial about a year ago, Collier's said:

We must put an end to the stopping of service in every basic industry—whether by lockouts, strikes, or financial buccaneering. No group shall deny to the rest of us the right to live.

We have got ourselves into the way of thinking that there is a real conflict between the parts of industry, and that the right to lockout, the right to strike, the right to take unearned profits, are fundamental and inalienable. Are they right? Are they fundamental? Are they more important than the right to carry a loaded revolver in crowded streets?

Our thinking is out of focus. We need a clearer, better-defined idea of what we are all about. A plan is needed, a new platform for all basic industries. No few men can make it. We must all get to work.

As the platform speaks for itself, we here reproduce it for our readers:

Plank 1—SERVICE

The main working rule for those who engage in any basic business must be service. The people, who maintain the market for all goods, energy and skill, must have a continuous supply of every essential of life. Service may be defined as the successful effort continuously to keep up supply, raise quality, and reduce cost. In the long run profits and wages are earned and should be received by any of us only in the measure that we serve.

Plank 2—REWARD

To serve the community a business must produce and distribute in such volume, and at fair prices, as to be able to take care of its own people. It must earn money to pay its workers wages which will support life in comfort. It must provide continuous work under healthful conditions, free the creative energies of all workers, and offer incentives to improvement of production.

Plank 3—CAPITAL

To provide means by which its workers can earn their living, a business must have capital. This money and property must be hired, as workers are hired, and must be paid for, as work is paid for. Capital is saved by many, not looted by a few, and that service of saving must be rewarded. In the interest of workers and the people every basic business must earn its way, pay a return on needed capital, meet its debts when due, and build strongly for the future.

Plank 4—MANAGEMENT

Earnings, through service, is the job of management. When a business does not pay fair wages for work and for capital, the fault is usually with management—in the factory, in the office, in sales, or in finance. If management is hampered by rules of government or labor, this is a condition which must be met and dealt with, not an excuse for failure. We must respect and reward the task and service of management.

Plank 5—LEADERSHIP

Owners, and leaders, are [illegible] responsible for management, whether good or bad, and [illegible] to pay, in reduced earnings, the penalty for [illegible] mistakes. The public must not be asked to pay higher prices, nor the workers to take lower wages, until all possible has been done to lower costs, better methods, stop gambling, improve merchandising, and thus increase earnings as based on service.

Plank 6—OPERATION

Management must keep the business going, and not shut down to gamble in prices or wages. It must plan the entire business—financing, buying, manufacturing, and selling—so that goods pass from raw materials to the consumer continuously and at steady prices based on service. Management must work for higher quality and for a constantly better use of machines and men, a constantly better organization of the field and of the industry. It should never be allowed to combine when it ought to compete, nor forced to compete when it ought to combine.

Plank 7—WORK

Workers, whether or not in labor organizations, must help increase production and promote good feeling within the business served by such trade. All working rules should increase output, harmonize and educate fellow workers, and strengthen the human desire to serve. Such rules should make for the increasing of real wages earned by work done and service given on the job.

Plank 8—CO-OPERATION

Workers and managers must know and have faith in one another. In each plant, district, or other units of basic industry there should be a council, works committee or other body of representatives, chosen by and from the workers in each such unit, to meet with the managers. These councils should confer on questions as to wages, working and business conditions and production. They should meet regularly and often, to prevent disputes, increase knowledge, and build the fellowship of service.

Plank 9—KNOWLEDGE

The main facts as to the life, growth, and progress of every basic business, whose service is essential to all the people, must be made public and available to the rank and file of workers, and to the people who look to the industry for service, as well as to stockholders, directors, and managers. For example:

- Balance sheet, principal items in detail, and explained.
- Routine report of expenses, profits and operating facts.
- Funds held by labor, by employers, and by civic bodies concerned with the industry.
- Grievances, remedies proposed, and agreements.
- Wage and salary scales, hours of labor, and working rules.

Plank 10—PEACE

The best arbitration is to need none. Government must not make arbitration compulsory, deny the right to work or to stop work, or decide issues arbitrarily by injunction. Workers and managers in the units of basic industry should plan in advance to submit to arbitration any differences which their own councils may be unable to settle. These agreements should name the chosen arbitrators and provide for publication of the facts, so that appeal may be made to public opinion. Public opinion, informed and organized, is the one compelling force which will build justice and peace in all our basic industries.

MANAGEMENT DATA

Standardized Methods and Accepted Practice Classified for Permanent Reference

Number 20

INDUSTRIAL ACCIDENT EXPERIENCE DATA

By J. D. HACKETT

Consultant on Labor Problems

Class Number
614.8 Industrial accidents

A MASS of information exists regarding industrial accidents. Most of it is in a form that makes it inapplicable directly to the individual plant. In order to give to a manager the worthwhile facts by which he can judge of the relative standing of his own concern in number and nature of accidents, and to enable him intelligently to plan and accomplish accident prevention work, with its resultant labor economy, the present investigation has been made. Facts have been gathered from a wide variety of reliable sources, including industries, trade, technical, and safety associations, and state and national government reports.

Five things must be known regarding groups of accidents if their study is to be of the greatest service in accident prevention:

1. The number of accidents occurring.
2. The industries in which they occur.
3. The causes of the accidents.
4. The amount of exposure to hazard.
5. The severity of the accidents.[1]

Two definitions will suffice to establish the basis upon which to consider the subject:

Accident. Any unexpected event, happening suddenly or violently, with or without human fault, which produces at the time injury to the physical structure of the body.

Tabulatable or lost-time accident. An accident causing death, permanent disability, or temporary disability beyond the day or turn in which the accident occurred.

The following tabulation is sufficiently extensive for the present purpose to serve as a classification of the causes of accidents:

ANIMALS

EXPLOSIVES, ELECTRICITY, FIRES, HOT SUBSTANCES AND CORROSIVES
- Boiler and steam-pressure apparatus
- Conflagrations
- Electricity
- Explosions of explosive substances
- Other explosions
- Hot substances and flames

FALLS OF PERSONS
- From elevations
- Into excavations
- On level

FALLING OBJECTS, NOT BEING HANDLED, IN[illegible]
- Collapse of buildings, piles, scaffolds
- From elevations
- In mines, quarries
- Into excavations
- Objects tipping over (except vehicles)
- Trees

HAND TOOLS, FLYING PARTICLES SET IN MOTION BY TOOLS

MACHINERY
- Conveyors
- Hoisting apparatus
  - Cranes
  - Derricks
  - Elevators
- Power transmission
- Power working machinery
- Prime movers
- Other working machines

MISCELLANEOUS CAUSES

POISONS, CORROSIVES, OCCUPATIONAL DISEASES

STEPPING ON OR STRIKING AGAINST OBJECTS

VEHICLES
- Automobile and other power vehicles
- Cars and engines, steam and electric railways
- Mine and quarry cars and motors
- Plant trucks on tracks
- Water craft
- All other vehicles

The number and per cent of accidents by causes are

[1] Statistics of Industrial Accidents in the United States Bulletin No. 339, Bureau of Labor Statistics, p. 2.

presented in Table 1 for 18 states for the year 1920, and in Table 2 for the two states of Wisconsin and Pennsylvania. Unfortunately, these two states do not use the same system of classification, so that the numbers and percentages for each cause are not directly comparable.

TABLE 1. ACCIDENTS, BY CAUSE, IN 18 STATES, 1920

CAUSE OF ACCIDENT	NO.	PER CENT
Machinery	151,750	21.25
Hot substances	39,553	5.55
Falling objects	74,832	10.48
Falls of person	74,368	10.39
Handling tools or objects	232,926	32.62
Vehicles	47,913	6.71
Unclassified	92,711	13.00
Total	714,023	100.00

TABLE 2. CAUSES OF ACCIDENTS IN WISCONSIN AND PENNSYLVANIA

CAUSES OF ACCIDENTS	WISCONSIN, 1919			PENNSYLVANIA, 1920	
	No. of Accidents	Per Cent of Accidents	Days Lost	No. of Accidents	Per Cent of Accidents
Handling objects	3,280	21.9	233,041	65,398	37.6
Working machinery	3,132	20.9	772,921	21,935	12.5
Falls of persons	1,894	12.6	340,130	20,187	11.5
Vehicles, cars, engines	1,308	8.7	367,822	18,369	10.5
Falling objects	1,231	8.2	253,694	22,378	12.7
Stepping on object, etc	1,028	6.8	89,409	...	...
Hand tools	994	6.6	86,953	...	...
Heat and corrosives	789	5.3	82,442	8,721	5.0
Hoisting machinery	488	3.3	265,884	...	...
Miscellaneous	462	3.1	120,790	17,991	10.2
Flying particles (n. o. c.)	223	1.5	61,782	...	...
Explosives	91	0.6	104,540	...	...
Electricity	75	0.5	82,395	...	...
Total	14,995	100.0	2,879,803	174,979	100.0

It is obvious that all causes of accidents are not mechanical. Other factors—personal, occupational, and environmental—enter in. Some workers are subject to accident through ignorance, others because of lack of mentality. This phase of the subject will be illustrated later under the discussion of extent of accidents.

Responsibility for Accidents

Responsibility for accidents divides into two main classes: Mechanical and personal.

Personal Responsibility. "A study of the causes of 220,707 accidents, which have occurred in the plants of the United States Steel Corporation, shows that but 4.9 per cent of the total number, except those in connection with overhead cranes, were due to machinery causes. Hand labor caused 44.42 per cent . . . the majority of which cannot be controlled by the use of safety devices and appliances. The conditions under which these accidents occur are due largely to carelessness or thoughtlessness . . . at least 90 per cent of the accidents might have been prevented if a little more care had been exercised." Bureau of Safety, United States Steel Corporation, 1920.

"Only 7 per cent of our accidents arise through defective machinery." C. R. Richards. National Safety Council Congress, October 1914.

"Even with more extensive guarding of machinery, stairways, etc., and all danger points made safe by mechanical guards, the human element leaves the way open to many injuries which could be avoided by the exercise of care by employees." *Iron Age*, August 5, 1915.

Mechanical. "Mechanical safeguards would have prevented but a small proportion of these accidents. They must be avoided, if at all, by the co-operation of employer and employee, which is only made possible to any great extent, by better shop management." Bulletin No. 12, Industrial Commission of Wisconsin, November 20, 1913.

Dr. Lucian W. Chaney, in Bulletin No. 298, of the Bureau of Labor Statistics, however, suggests the importance of "engineering revision" in preventing serious accidents. Out of 327 deaths in the iron and steel industry, he points out, 212 could have been prevented by some engineering revision.

Determination of Responsibility. Responsibility may be fixed by considering the following:

1. Failure to supply or use safety devices.
2. Failure to supply or use proper tools or appliances.
3. Violation of rules.
4. Improper acts of employer, employee, or fellow worker.
5. Selection or use of improper methods.
6. Carelessness.
7. Failure to instruct or to obey instructions.
8. Trade risk.

Accident Prevention

The sole object of a study of accidents and determination of the responsibility for them is to prevent recurrences of the happenings. In addition to altruistic motives, prevention has the very practical aspect of large economies in the cost of labor.

The *fundamentals* in accident prevention are to:

1. Secure the manager's support.
2. Convince the manager of the importance of the work.
3. Get him to secure co-operation from the employees.

Methods of accident prevention divide naturally into three groups:

1. Engineering revision
   - (*a*) Application of engineering skill to safety.
     1. Design and location of buildings.
     2. Safe access to where workers go.
     3. Adequate and properly arranged lighting.
     4. Machines designed from safety standpoint.
     5. Guarding of machines of faulty design.
2. Supervision
   - (*a*) Safeguarding of machines.
   - (*b*) Cultivation of safe practices.
   - (*c*) Ascertainment of fire hazards.
   - (*d*) Promotion of cleanliness.
3. Education
   - (*a*) By bulletin board.
   - (*b*) Safety articles in plant magazine.
   - (*c*) Distribution of printed matter.
   - (*d*) Safety meetings.

(*e*) Safety committees.
(*f*) Suggestion systems.
(*g*) Prizes and rewards for good record.
(*h*) Special contests and campaigns.

Relative value of different methods of prevention, as suggested by R. J. Young, Illinois Steel Company, are:

FACTOR	PER CENT	TOTAL PER CENT FOR GROUP
Organization		
Attitude of officers	20	
Safety committees	20	
Inspection (workmen)	5	
	—	45
Safeguarding		
Safety devices	17	
Lighting	5	
Cleanliness	3	
	—	25
Education		
Instruction of men	15	
Prizes	9	
Posting signs	3	
Lectures	3	
	—	30
Total		100

Organization. Accident prevention is hardly possible without organization. The Department of Labor and Industry of Pennsylvania has under consideration the adoption of the following safety organization code as a suggestion for use in the individual plant.

1. Plan of organization.
   (*a*) Every establishment shall organize and maintain an organization for the safety of its employees.
   (*b*) Every establishment shall be free to adopt a plan which is best suited to the nature, size, and peculiar conditions obtaining in it.
2. Inspection.
   (*a*) Every establishment shall be inspected regularly at fixed intervals.
   (*b*) Copies of reports of inspections shall be accessible at all times to the duly authorized representatives of the Department of Labor and Industry.
3. Safety Education.
   (*a*) Every establishment shall have as part of its safety organization some means for the continuous and systematic inculcation of safe practices.
   (*b*) Bulletin boards shall be provided on which to put information relating to safety.
   (*c*) The bulletin boards shall be located at such points as will bring the material posted thereon to the attention of all the employees in the plant.
4. Accident records.
   (*a*) Suitable records of accidents shall be kept by every establishment.

Records and Reports. Intelligent efforts toward accident prevention cannot be made without data upon which to act. Whenever an accident occurs a complete report made out immediately and correctly becomes the basis for remedial measures.

Accident reports should contain all information necessary for a full statistical study of accidents; they should, therefore, be based on statistical requirements. The following items are included in a full record:

I. Facts as to the injured person.
   1. Check number.
   2. Name.
   3. Address.
   4. Age.
   5. Sex.
   6. Marital condition.
   7. No. of children.
   8. Nationality.
   9. Language spoken.
   10. Occupation.
   11. Department.
   12. Foreman in charge.

II. Facts as to accident.
   13. Date of injury.
   14. Day of week.
   15. Time of day.
   16. Exact place.
   17. Department.
   18. Cause of injury (Immediate).
   19. Cause, contributory.
   20. Nature of injury (Bruise, cut, etc.)
   21. Extent of injury. (Severe, slight.)
   22. Location of injury. (Left side, etc.)

III. Facts as to time and cost.
   23. Length of employment, in plant.
   24. Length of employment, at specific job.
   25. Witnesses to accident. (Names, addresses, etc.)
   26. Probable length of disability.
   27. Date of return to work. (Or severity rate in days.)
   28. Number of working days lost.
   29. Wages at time of accident.
   30. Treatment given by.
   31. Amount of compensation paid.

Method of Calculating Accident Data

The purpose of gathering statistics of accidents is, as has been stated, to use them as a basis of prevention. But the mere number of accidents insufficiently indicates the extent of the problem. To secure a full picture one has to know the severity as well as the frequency of accidents. Also, since some men work 5 days and others 6 days a week, at the rate of 8, 10 or 12 hours per day, there should be some unit which brings the facts to a comparable basis. Hence, accidents are calculated according to the following:

1. *Frequency.* The number of accidents occurring in a plant are expressed in rates per million hours exposure; this is termed the *Frequency Rate.* The International Association of Industrial Accidents Boards and Commissions computes rates on the basis of thousand hours' exposure, or man-hours worked.

2. *Severity.* The *Severity Rate* may be expressed as number of days lost per thousand hours' exposure. Rates for the "full-year" worker (a hypothetical worker, supposed to work 10 hours a day for 300 days in the year), may be obtained by multiplying the rate given by 3.

In the case of death or permanent disability, the number of days lost should be estimated according to the "Scale of Time Losses" of the International Association of Industrial Accident Boards and Commissions. A severed finger may involve no lost time but its severity is rated at 300 days (upon which basis compensation is paid). Therefore, 300 days is added to the actual number of days lost to get the severity rate.

Injuries—Nature, Extent and Location

Nature. Table 3 gives the number and relative percentages of injuries, classified according to the nature of the injury, for accidents occurring in 12 selected

industrial states during 1920. Table 4 gives similar data for the state of Pennsylvania for 1920. Lack of uniformity in reporting statistics from many states makes Table 3, especially in the ratio of unclassified accidents, less specific and useful than Table 4.

TABLE 3. NATURE OF INJURIES IN 12 STATES, 1920[1]

Nature of Injury	Number	Per Cent
Amputations	8,338	1.9
Asphyxiations	313	0.1
Burns, etc	26,006	5.7
Bruises	141,694	31.1
Cuts, lacerations, and punctures	133,958	29.6
Fractures	42,045	9.3
Sprains and dislocations	61,968	13.7
Unclassified	38,597	8.5
Total	452,919	100.0

[1] Statistics of Industrial Accidents, Bulletin No. 339, U. S. Bureau of Labor Statistics, p. 20.

TABLE 4. NATURE OF INJURIES, PENNSYLVANIA, 1920[1]

Nature of Injury	Number	Per Cent
Amputations	1,566	0.9
Asphyxiations	287	0.2
Burns and scalds	11,569	6.6
Crushes and bruises	71,128	40.7
Cuts and lacerations	44,828	25.6
Drowning	23	....
Fractures	14,816	8.5
Hernia	1,668	0.9
Punctures	7,078	4.0
Sprains and dislocations	20,682	11.8
Unclassified	1,334	0.8
Total	174,979	100.0

[1] Statistics of Industrial Accidents, Bulletin No. 339, U. S. Bureau of Labor Statistics, p. 27.

TABLE 5. PARTS OF BODY INJURED. DATA FROM 11 STATES, 1920

Location of Injury	Number	Per Cent
Head, face and neck	34,106	7.4
Eyes	29,663	6.4
Trunk	69,813	15.2
Upper extremities	188,940	41.2
Lower extremities	131,499	28.4
Unclassified	6,513	1.4
Total	460,534	100 0

Location of Injury. The number and per cent of accidents occurring in 11 states during 1920, classified by location of injury, are given in Table 5. Similar data are given for Pennsylvania, during 1920, in Table 6.

The latter table gives more details than the former, but as Table 5 groups upper extremities and lower extremities separately, and Table 6 segregates injuries by arms, hands, fingers, etc., the grouping is directly comparable.

TABLE 6. PARTS OF BODY INJURED. PENNSYLVANIA, 1920[1]

Location of Injury	Number	Per Cent
Trunk	30,235	17.3
Head and face	15,354	8.8
Eyes	11,597	6.6
Arms	9,248	5.3
Hands	19,884	11.4
Fingers	35,730	20.4
Legs	17,985	10.3
Feet	25,687	14.6
Toes	9,259	5.3
Total	174,979	100.0

[1] Statistics of Industrial Accidents, Bulletin No. 339, Bureau of Labor Statistics, p. 27.

The Occupational Factor in Accidents. The character and speed of work affect the accident rate. Increased length of employment, indicating experience and increased skill, reduce the accident risk. The figures in Table 7, from a large steel plant, January to May, 1916, indicate this. Table 8 brings out the same fact for the metal trades.

TABLE 7. LENGTH OF EMPLOYMENT AS IT AFFECTS ACCIDENTS

Data from Steel Mill, Jan.-May, 1916[1]

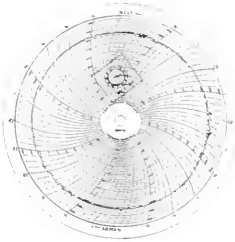
Length of Employment	Equivalent Full Year Workers	Number of Accidents	Frequency per Million Hr. Exposure
Six months and under	512	57	37.1
Over 6 months and not over 1 year	278	29	31.8
Over 1 year and not over 3 years	357	31	28.9
Over 3 years and not over 5 years	637	27	14.1
Over 5 years and not over 10 years	814	16	6.6
Over 10 years and not over 15 years	470	4	2.8
Over 15 years	459	00	0.0
Total	3527	164	15.5

[1] "Cause and Prevention of Accidents in the Iron and Steel Industry," 1910-1919, p. 167.

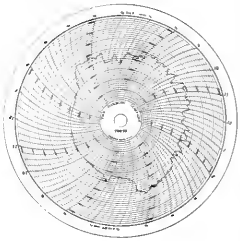
The Age Factor in Accidents. The number of accidents varies with the age of workers. This is illustrated in Table 9, showing accident frequency and severity rate for a large steel plant, 1907 to 1914, by age groups.

"FEATURES" or RESULTS

Which Do You Buy?



Record of pressure in steam main made by a Foxboro Recording Gauge in the Chief Engineer's Office, Salem Electric Light Co., Salem, Mass.
This record gives the chief a constant check on boiler operation and the efficiency of the fireman, and is a necessary factor in determining turbine efficiency.



Record of flue gas temperature made by a Foxboro Recording Thermometer at the National Blank Book Co.'s Plant, Holyoke, Mass.
Between 400 and 500 degrees Fht. during the load period indicates that very little heat is wasted in this plant.

It's the record, not the instrument producing it, that enables you to cut costs and save time.

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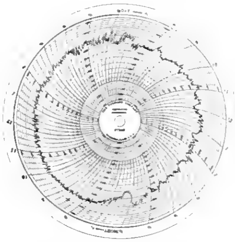
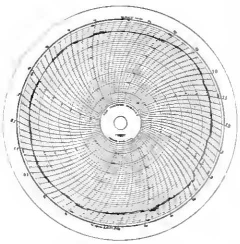
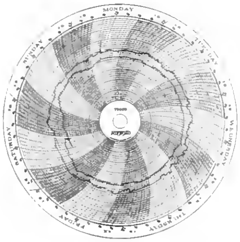
Write for Recording Thermometer Bulletin AE-114-1 and Recording Gauge Bulletin AE-98-2.



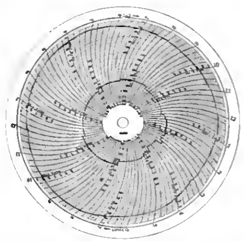
Record of feed water temperature made by a Foxboro Recording Thermometer in a textile mill power plant. Load variations during the day and uniformity of load at night are plainly shown.
The fidelity with which the slightest temperature variations are recorded is a noticeable characteristic of all Foxboro charts.



Record of cold storage room temperature at the plant of the People's Ice Co., Chicago, Ill. Note the even temperature. Fluctuations would indicate heat losses.



Record of wet and dry hulb temperatures made by a Foxboro Recordiog Psychrometer in the dough raising room of Regan Bros. Co. Bakery. This chart is a fine example of the accuracy with which humidity can be controlled by hand when guided by the Foxboro record.



Record of water level in the forebay and tailrace made by a Foxboro Two-Pen Liquid Level Recorder at the Northwest Paper Co.'s Plant, Cloquet, Minn.
The head on the water wheel is determined at a glance.
Foxboro two-pen records are widely used where accurate comparisons are desired not only of liquid levels, but of temperatures and pressures.

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THE COMPASS OF INDUSTRY

TABLE 8. LENGTH OF EMPLOYMENT AS IT AFFECTS ACCIDENTS
Data from Metal Trades[1]

Length of Employment	Average Number Injured per Day		
	Male	Female	Total
First day	166	294	460
Second day to end of first week....	38	45	83
Second week to end of first month...	11	6	17
Second month to end of sixth month	3	1	4
Seventh month to end of first year..	1	0.5	1.5
Total.....	219	346.5	565.5

[1] "Report on Condition of Woman and Child Wage-Earners," Vol. XI, S. Doc. No. 645, 61st Cong. 2nd Sess.

TABLE 9. THE AGE FACTOR IN ACCIDENTS
Data from Large Steel Mill, 1907 to 1919[1]

Age	Number of Workers	Frequency (per million hr. exposure)				Severity (per 1000 hr. exposure)			
		Death	Permanent Disability	Temporary Disability	Total	Death	Permanent Disability	Temporary Disability	Total
Under 20	949	0.31	2.47	184.8	187.58	2.10	1.47	2.57	6.14
21 to 29 ..	16,443	0.23	1.13	76.7	78.06	1.33	0.77	1.17	3.27
30 to 39 .	14,417	0.23	0.80	58.5	59.53	1.37	0.40	0.97	2.74
40 plus ..	11,124	0.17	0.93	42.8	43.90	1.10	0.50	0.87	2.47
Total..	42,993	0.23	1.00	64.2	65.43	1.30	0.60	1.03	2.93

[1] "Causes and Prevention of Accidents in the Iron and Steel Industry," 1910-1919. Bulletin No. 298, Bureau of Labor Statistics, p. 175.

Nationality of Injured Employees. Table 10 shows cases reported to the Workmen's Compensation Bureau, Pennsylvania, 1920, and classifies accidents by nationality. Table 11 shows similar data for a specific industry.

TABLE 10. ACCIDENTS CLASSIFIED BY NATIONALITY
State of Pennsylvania, 1920

Nationality	Deaths	Permanent Disability	Temporary Disability		Total
			Compensable	Non-compensable	
United States	1311	193	54,208	46,869	102,581
Austro-Hungary	139	18	4,724	4,171	9,052
Germany	27	1	1,129	738	1,895
Great Britain	50	5	1,329	936	2,320
Ireland .	39	4	1,053	708	1,804
Italy	184	20	6,684	5,769	12,657
Poland	210	22	5,841	4,634	10,707
Russia	65	8	1,791	1,598	3,462
Slavish	122	9	4,013	3,407	7,551
Scandinavia	13	1	352	259	625
Other	78	10	4,279	3,420	7,787
Negro	171	11	5,370	4,249	9,804
Not given.	116	15	2,508	2,095	4,734
Total	2528	317	93,281	78,853	174,979

Americans and Irish may be presumed to understand English and, therefore, to be more amenable to education in accident prevention than the others. Difference in occupational risk is probably another factor.

Language. Table 12 shows accidents occurring during a period of 8 years in a large steel plant, classified according to language—English or foreign.

TABLE 11. ACCIDENTS CLASSIFIED BY NATIONALITY
The Scovill Manufacturing Co., 1919

Nationality	Employees		Accidents per Employee
	Number	Per Cent	
American	3331	46.0	0.91
Albanian	138	1.9	1.68
Irish	478	6.6	0.69
Italian	1361	18.8	1.27
Lithuanians	290	4.0	1.01
Polish...	225	3.1	1.67
Portuguese.	225	3.1	0.78
Russian .. .	543	7.5	1.18
Miscellaneous	651	9.0	1.14
Total	7242	100.0	

The non-English speakers have a frequency rate 2.3 times higher than American born (70.9 against 30.2 per million hours' exposure for 8 years), and a severity rate 1.4 times as great (7.5 against 5.3 days per 1000 hours' exposure).

According to figures issued by the Ohio Industrial Commission, more than 50 per cent of the fatal accidents which occur in Ohio industries are those of foreigners, or men who cannot read the English language.

TABLE 12. LANGUAGE FACTOR IN ACCIDENTS
Eight Years' Experience in a Steel Plant

Group		Full Year Workers	Accident Frequency (per million hr. exposure)				Accident Severity (per thousand hr. exposure)			
Birth	Language Spoken		D'ths	Permanent Disability	Temporary Disability	Total	D'ths	Permanent Disability	Temporary Disability	Total
American	English	12,587	0.7	0.9	28.6	30.2	4.1	0.7	0.5	5.3
Foreign	English.	18,746	0.8	1.3	30.8	32.9	4.7	1.4	0.7	6.8
Foreign	Non-English	22,910	0.9	2.2	67.8	70.9	5.1	1.5	0.9	7.5
Total		54,243	0.8	1.6	45.9	48.3	4.7	1.4	0.8	6.9

Sex. The 1920 figures for Pennsylvania accidents, classified by sex, are shown in Table 13. Since fewer females are engaged in industry, and generally at light work, the statistics do not indicate that men are more subject to accidents than women.

TABLE 13. ACCIDENTS CLASSIFIED BY SEX OF INJURED
All Accidents Reported in Pennsylvania, 1920

Sex	Deaths	Permanent Disability	Temporary Disability	
			Compensable	Non-compensable
Male	2514	313	90,682	76,785
Female	14	4	2,599	2,068

Accidents by Hours of Day. The distribution of accidents in the cement industry according to hours of

the day during which they occurred is shown in Table 14. Accidents are most numerous from 10 to 11 in the forenoon and from 3 to 4 in the afternoon.

TABLE 14. TIME OF DAY WHEN ACCIDENTS OCCURRED
Portland Cement Industry[1]

Hour	No. of Accidents	Days Lost	Average Days Lost per Accident	Per Cent of Total Accidents
A. M.				
12- 1	44	616	14	1.9
1- 2	23	276	12	1.0
2- 3	24	396	16.5	1.0
3- 4	28	431	15.3	1.2
4- 5	27	418	15.5	1.1
5- 6	21	319	15.2	.9
6- 7	51	1086	21.2	2.1
7- 8	83	1412	17	3.5
8- 9	162	2339	14.4	6.9
9-10	186	2558	13.7	8.0
10-11	317	4474	14.1	13.5
11-12	231	3248	13.8	9.9
P. M.				
12- 1	71	818	11.5	3.1
1- 2	120	2213	18.4	5.1
2- 3	222	3240	14.5	9.4
3- 4	231	3381	14.6	9.8
4- 5	172	2129	12.3	7.3
5- 6	77	722	9.3	3.3
6- 7	36	716	19.9	1.5
7- 8	22	301	13.7	.9
8- 9	26	636	24.4	1.1
9-10	14	284	20.3	.6
10-11	40	677	16.9	1.7
11-12	29	579	19.9	1.2
Not given	95	1527	16	4.0
Totals	2355	34,796	14.7	......

[1] Annual Report of the Bureau of Accident Prevention, Portland Cement Association, 1918.

Accidents by Days of the Week. Classification by days of the week does not appear to have much significance. Table 15 gives data collected from the cement industry and brass manufacturing. The Sunday record is low because of the few men working on that day.

Extent and Cost of Industrial Accidents

Table 16 is a classification of accidents by industries compiled for 21 states, and shows the great extent of injuries and deaths.

TABLE 15. ACCIDENTS BY DAYS OF THE WEEK

Day of Week	Cement Industry 1918[1]		Brass Mfg. 1919[2]
	No. of Accidents	No. of Days Lost	No. of Accidents
Monday	372	5,030	1,384
Tuesday	383	5,522	1,388
Wednesday	348	4,567	1,395
Thursday	370	5,542	1,414
Friday	397	7,233	1,399
Saturday	333	4,601	551
Sunday	152	2,301	20
Total	2,355	34,796	7,551

[1] Report of Bureau of Accident Prevention, of the Portland Cement Association, 1918.
[2] Fifth Annual Report of the Industrial Hospital of the Scovill Manufacturing Co., 1919.

The total cost of industrial accidents is not known but it reaches hundreds of millions of dollars. The employer loses production and pays out large sums for prevention, medical relief, and compensation. The worker loses in wages, skill, and morale, apart from the actual injury.

TABLE 16. EXTENT OF ACCIDENTS BY INDUSTRIES
Compiled for 21 States, 1920[1]

Industry	Accidents	
	Number	Per Cent
Agriculture	5,354	0.88
Chemicals	9,390	1.56
Clay, glass, and stone	12,443	2.08
Clothing	2,848	0.47
Construction	54,337	9.07
Food products	26,881	4.48
Leather and rubber	9,477	1.58
Lumber and its manufacture	42,465	7.08
Mercantile	17,215	2.87
Metals and metal products	129,659	21.62
Mines, coal	77,372	12.89
Mines (not coal), and quarries	36,360	6.07
Municipal	2,272	0.38
Oil and gas	9,216	1.53
Paper and products	5,794	0.97
Printing and publishing	5,944	0.99
Public service	59,631	9.96
Shipbuilding	8,516	1.42
Textiles	15,754	2.63
Unclassified	68,803	11.47
Totals	599,731	100.00

[1] Statistics of Industrial Accidents, Bulletin 339, Bureau of Labor Statistics, p. 25.

The Report of Industrial Commission of Wisconsin, 1922, gives the following:

Cost of all benefits	$2,959,947.00
Average cost per case	176.00
Average amount of indemnity	2,252,138.00
Average indemnity per case	134.00
Amount of medical aid	707,836.00
Average amount of medical aid, per case	42.00

According to statistics of F. S. Crum, Prudential Insurance Company, the total wage loss is computed at $1,168,000,000 annually.

Results from Accident Prevention Methods. Prevention work makes vast savings possible in amount of compensation payments. Of even more importance are the gains in production per man, and per hour, because of the elimination of accidents with their costly overhead due to idle equipment, green men as substitutes, and the like. The following figures from the United States Steel Corporation, show for each year the number of persons saved from serious injury and the per cent of accident decrease per thousand employees, using 1906 as a basis.

Year	Saved from Serious Injury[1]	
	Number	Per Cent
1907	532	10.10
1912	2,023	36.06
1917	2,891	41.63
1922	2,971	56.13

[1] U. S. Steel Corporation, Bulletin No. 9. Safety, Sanitation and Welfare.

MANAGEMENT AND ADMINISTRATION

FOR OFFICERS EXECUTIVES AND DIRECTORS OF INDUSTRY

Editors: L. P. Alford, Hugh R. Conyngton

Associate Editors: Frank A. Fall, George E. Hagemann

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Cover Illustration of The Sherman Creek Generator Station, by courtesy of the United Electric Light and Power Company

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Authors and Articles for December

THE opening instalments of two strong serials which will present unusually helpful information with regard to capital control and budgetary control are in this issue. The first, under the general title, "Capital Requirements and Control," is by J. H. Bliss, Controller of Libby, McNeill & Libby, and chairman of the Committee on Standardized Accounting, Institute of American Meat Packers.

The second, on "Control Through Organization and Budget," is the joint contribution of Thomas B. Fordham and Edward H. Tingley. Mr. Fordham for the past 3½ years has been Superintendent of the Delco-Light Company. Formerly he was an Industrial Engineer, member of the firm of J. L. Nicholson & Company. Mr. Tingley is an Engineer associated with Mr. Fordham. For the past 3½ years he has been in charge of plant layout, factory system, factory budget compilation, and analysis work at the Delco-Light Company. Former connections have been with Westinghouse Electric & Manufacturing Company on electrical construction work, and assistant to the superintendent of the F. N. Burt Company.

Consideration of the most pressing problems facing the management of industry today is satisfied by the articles of Mr. Bliss, Edward S. Evans and James A. Shepard. The first has already been referred to, the second deals with lowering costs of distribution, and the third with reduction in material-handling costs. Mr. Evans, President of E. S. Evans and Company, Inc., has effected savings in the shipping of motor cars, conservatively estimated at $50,000,000. Mr. Shepard is Vice-President and Chief Engineer of the Shepard Electric Crane and Hoist Company, with which he has been connected for over 20 years.

Two articles giving details of managerial experience are by John L. Walther and Luther D. Burlingame. Mr. Walther, who is President of the Walther Manufacturing Company, presents an article of unusual value, for he points out concrete advantages which have been secured from the cost system installed as a part of the control in the manufacture of high-grade woolens and dress-goods. Mr. Burlingame, Industrial Superintendent of the Brown and Sharpe Manufacturing Company, tells of a method whereby recognition of long service is given by posting the names of both employees and executives who have served 25 years or more, on an honor roll in the company's office.

For several months past, Dean Dexter S. Kimball has been presenting in MANAGEMENT AND ADMINISTRATION fundamental economics, both in principle and practice, underlying the organization and development of modern industry. Prof. Kimball is Dean of the College of Engineering of Cornell University, and writes from an unusually wide experience, having been 17 years in industry, occupying positions from machinist apprentice to works manager.

The vital topic of business forecasting is presented from two widely different points of view by Joseph H. Barber and Carl Snyder. Mr. Barber's article is on "Checking Up the Forecast" and is written from the practical experience of his own organization, the Walworth Manufacturing Company, of which he is statistician. Mr. Snyder, Chief Statistician of the Federal Reserve Bank of New York, has given close attention to the development of indices of industry and business. In his article he describes a new index which is being developed by his bank under the general headings of "Productive Activity," "Primary Distribution," "Distribution to Consumers," "General Business Activity," and "Financial Activity."

R. W. Darnell, Controller of the Ritter Dental Manufacturing Company, attacks the elusive and troublesome problem of the control of overhead under the title, "Establishing Overhead Standards."

Turning now to a strictly financial problem, Dr. W. Randolph Burgess, Manager of the Reports Division of the Federal Reserve Bank of New York, interprets the effect of the federal reserve system on interest rates. His opportunities for observing the working of this system at close range have been exceptional and he maintains that the system is likely to have little direct effect on the general level of interest rates, but by giving greater fluidity and elasticity to credit it has greatly reduced seasonable and other fluctuations in the general interest rate.

The summary and data article is by H. W. Maynard, Comptroller of the Salt's Textile Manufacturing Company, formerly engaged in cost accounting work with the General Electric Company. He classifies expense items under two heads—major charges, and miscellaneous expense.

THE PUBLISHERS' PAGE

Looking Ahead to 1924

WORK is well advanced on a carefully-planned editorial program for MANAGEMENT AND ADMINISTRATION during 1924. We are gratified to be able to announce to our subscribers that the magazine throughout the coming year will not only maintain but surpass the high standard set by recent issues. Never before has so distinguished a list of contributors or such a collection of important articles been brought together by any publication in the management field.

Arrangements have been made thus far for articles from more than 100 contributors. Eight notable series are ready for early publication. A new department will be added in January which will list, index, and describe current management books, pamphlets, and articles selected from 150 periodicals.

There is no space to mention more than a few of those who will contribute to MANAGEMENT AND ADMINISTRATION during 1924. This list is typical:

E. T. Trigg,
President,
John Lucas & Co., Inc.

J. P. Jordan,
President,
National Assn. of Cost Accts.

Alfred H. Swayne,
Vice-President,
General Motors Corporation

George D. Babcock,
Works Manager,
Holt Mfg. Company

Howard Coonley,
President
Walworth Mfg. Company

F. L. Sweetser,
General Manager,
Dutchess Mfg. Company

James W. Young,
Vice-President,
J. Walter Thompson Company

E. Karl Wennerlund,
Head, Dept. of Factory Organization,
General Motors Corporation

Clinton E. Woods,
Consulting Industrial Engineer

Robert H. Montgomery,
Member of the Firm,
Lybrand, Ross Bros. & Montgomery

G. Charter Harrison,
Consulting Cost Accountant

Henry Bruere,
Vice-President,
Metropolitan Life Ins. Co.

C. U. Carpenter
President,
Dayton Portable Typewriter Co.

H. Parker Willis,
Editor,
Journal of Commerce

Ralph H. Allen,
Asst. Financial Executive,
Thos. A. Edison Industries

Arthur Andersen,
Member of the Firm,
Arthur Andersen & Company

J. O. McKinsey,
Member of the Firm,
Frazer & Torbet

J. Karl Mason,
Controller,
New England Confectionery Co.

J. H. Bliss will continue his series "Capital Requirements and Control" which begins on page 705 of this issue. His articles will prove of interest and of definite value to managers who wish to increase the usefulness of the reports and records submitted for their decisions in effectively utilizing and safeguarding the capital entrusted to their direction. The articles by T. B. Fordham and E. H. Tingley, of the Delco-Light Company, beginning on page 719, will also carry over into 1924; they warrant the careful study of every organization.

The General Motors Corporation is represented in an important series beginning in January. The contributors include Donaldson Brown, Alfred H. Swayne, and C. S. Mott, who are vice-presidents in charge of various activities of this huge organization, and E. Karl Wennerlund, who is at the head of the department of factory organization. The articles will deal with the financial and production control of the Corporation; its handling of working capital; the yearly and monthly forecast system; its method of determining prices; physical control of materials, etc.

Also in January we begin a series by Frederick A. Waldron, consulting organization engineer, which presents a co-ordinated system of planning, routing, and cost accounting which is in successful use in numerous industrial plants.

Other series ready for early publication include: "Industrial Investigations," by Arthur Andersen, of Arthur Andersen & Company; "Modern Methods in a Small Factory," by Geoffrey C. Brown, Chief Engineer, Jacques Kahn, Inc.; "Methods of Modern Management," by C. U. Carpenter, President of the Dayton Portable Typewriter Company; "Holt Methods of Production Control," by George D. Babcock, Works Manager, Holt Mfg. Company.

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

PREPARED BY LEWIS H. HANEY
Director, New York University Bureau of Business Research

Barometer of Industry and Trade

Growing Indications of Improved Business Future

The prospects for a moderate upturn in business early in 1924 continue bright. Probably by February, or March at the latest, it will become generally apparent that a real upswing is in progress.

The coming gains in industry will probably not be of a very sharp or pronounced character because of the well-known, unsettled conditions in Europe and the continuance of some maladjustments in their own industries; but there are no indications of any setback as yet. (It is believed that the readers of this department of MANAGEMENT AND ADMINISTRATION will receive from four to six months' notice of the approach of any recession in business.)

Further gains in the stock market are probable. Aside from technical recessions, which are bound to come as the upward impetus resulting from short covering ceases, the general trend of the stock market should be upward during the next 60 days.

Meanwhile business recession will continue in some lines and a spotty condition is likely to prevail for the rest of the year as has been forecast in these pages. The oil industry is in a decidedly weak situation for the present. The iron and steel industry is not out of the woods. Production of copper is probably in excess of immediate demand; and stocks of leather and automobile tires are still unduly large. The textile industry, too, continues unsettled.

The point to be emphasized is that these conditions do not warrant pessimistic conclusions as to the *future*. Actual business is now near the bottom of the current recession. The [illegible] of the present, but the forecast for [illegible] is bright.

The forces making for stabilization of industry and recovery in our domestic business are actively at work. Iron furnaces are being blown out and the turn in the pig iron market seems not far distant. In the oil industry the darkest hour is nearly always before the dawn, and the continued decisive cuts in the price of crude oil are the best evidence that overproduction will cease. It is rumored that plans are on foot in the copper industry to curtail production, and consolidations looking toward better control and stabilization are being talked of.

A factor of fundamental importance is the general decrease in production in basic industries as reflected in the index prepared by the Federal Reserve Board. This index has declined in relation to the index of railway tonnage, which fact indicates that shipments are beginning

FIG. 1. THE BAROMETER OF INDUSTRY AND TRADE

Areas in which curves lie indicate that business is good, normal or poor, respectively. Curve P V shows the trend of commodity demand, and is the ratio between Bradstreet's index of wholesale prices and physical volume of trade (carloadings times tons per car), based on 1912 as the normal year. A rise in the curve indicates increasing demand, and vice versa. Interest rate curve has been corrected for seasonal variation, and index number 100 equals 5 per cent. Federal reserve ratio of cash reserves to note and deposit liabilities is inverted to harmonize its indications with the rest of the curves, and is corrected for seasonal variation on revised basis from January 1923 on. Business failure bars are based on Dun's reports, and "normal" equals the trend for 40 years. Six Commodity price index based on N. Y. U. Bureau special investigation. November 1923 data shown is probable trend.

to gain on stocks of basic commodities. One of the clearest indications of the causes of the recent recession in industry was the fact that production in basic industries mounted more rapidly than railway tonnage, showing the accumulation of stocks of basic products at mines, mills, and refineries.

The upswing in retail distribution which was marked in October further supports the reasoning that sales are beginning to cut into excess stocks and will in time bring about a readjustment which is fundamental.

The chief factor which forecasts better business within three or four months now, is the gain in the relative strength of demand. This is a positive forecaster. To begin with, the P/V line in our barometer, Fig. 1, has now moved up for three months in succession. This means that the supply of commodities in general, or the physical volume of trade, has become so adjusted with relation to market conditions as reflected in prices that the demand for goods has increased in intensity. The price decline has been checked, and the index of wholesale prices has actually shown a tendency to increase. In the past, the P/V line has forecast the trend of business by from four to six months and there is every reason to believe that it will continue to do so.

In line with the foregoing fact is the decided gain in the sales of mail order and chain store concerns. In October such sales, after eliminating seasonal variation, increased from 5 to 10 per cent over September; that is, these retail concerns had sales which were from 5 to 10 per cent greater than the usual seasonal gains over September. This is a clear indication of better purchasing power and more active demand.

If further evidence were required it might be found in our imports, which are one of the best indications of the trend of conditions throughout the country. Preliminary figures for October show that imports gained 23 per cent in comparison with September. Moreover, this gain is considerably greater than the usual increase in October.

The same line of reasoning is supported by the examination of conditions which affect the purchasing power of consumers. It has become clear that the condition of farmers has been considered in too pessimistic a way. On the whole, crops are larger than a year ago and at the same time farm prices on the average are better. The result is that the total value of crops is much greater than in recent years. Of course, wheat farmers in the Dakotas have been hard hit by small yields, but their condition is much more than offset in other sections.

The purchasing power of laborers continues high. Earnings of factory employees are considerably greater than they were a year ago and appear to be in a fairly stable condition. Wage rates are well maintained and employment is holding at a high level. Moreover, the figures showing deposits in savings banks indicate that at present such deposits are 10 per cent greater than they were a year ago, which seems to show the general condition of thrift which is certainly desirable.

The moderate boom in the spring was largely based on the demand for building and construction. It is, therefore, significant to note that the nation is still far behind with its building program, and that all indications point toward a high level of activity in this field next year. Already the curves of contemplated constructions and contracts awarded are turning upward. In this connection we may note that the production of automobiles in October showed an increase which was about the same as that which occurred in 1922, though the percentage of gain was smaller. Apparently, therefore, the demand for steel is going to increase.

As to the general level of prices, the evidence points to the conclusion that it is now near the bottom and that the general trend during the next few months will be in an upward direction, though the movement will doubtless be irregular until further readjustment has been made in production and stocks in certain basic industries.

While we would emphasize the point that conditions in the money market are of little value as a positive forecaster of the trend of business, they have value as indicating conditions which facilitate the action of demand supply factors. The general trend of the interest rate has recently been slightly downward. The continued ease in the money market and the abundant supply of credit indicate the conditions are such as to facilitate business improvement. Moreover, it is rarely, if ever, the case that we have a depression following a period of such relatively low interest rates as have obtained now for many months.

The dark spots continue to be: (1) Europe; (2) Legislative uncertainty; (3) High cost of labor. No great change is apparent in these matters. The first two cannot be forecast.

Production and Stocks of Commodities

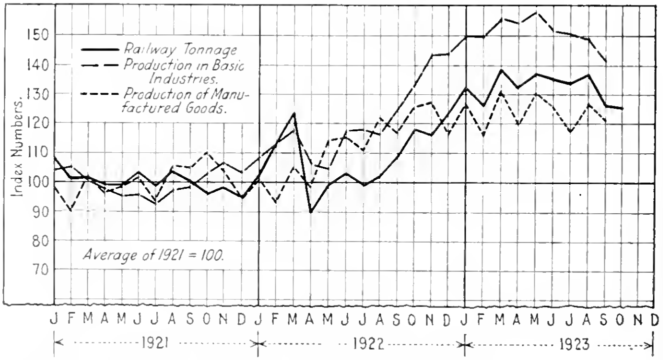
Output Adjusted: Stocks in Liquidation

Production and Railway Tonnage

The curves shown in Fig. 2 all indicate a declining tendency showing that in September and October the recession in industry was still going on.

Two facts are outstanding: (1) The rates of production and of railway traffic in September and October were considerably greater than at the same time a year ago. (2) The volume of production in basic industries has been declining more rapidly than the volume of railway tonnage, showing that accumulated stocks of basic commodities are passing into the channels of trade.

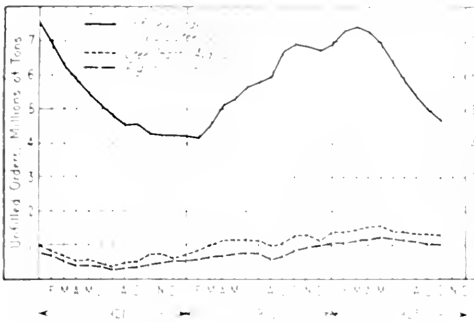
Relatively little change is shown in the general trend of the production of manufactured goods. It has declined in a general way since the peak in March but during September was nearly 4 per cent greater than last year at the same time.



Sources, Federal Reserve Board, N. Y. U. Bureau of Business Research

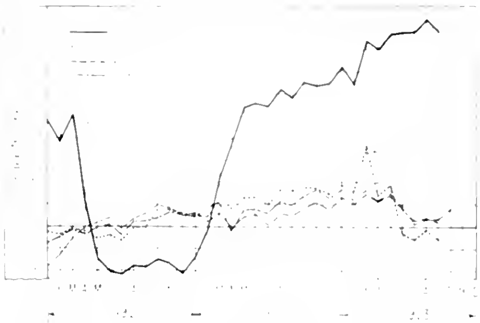
Fig. 2 Railway Tonnage and Production in Industry

Railway tonnage and basic industries production corrected for seasonal variation, and the latter also for normal growth.



Sources, Iron Age; American Iron and Steel Institute.

Fig. 3. Iron and Steel Production and Unfilled Orders



Sources, American Bureau of Metal Statistics; Federal Trade Commission; Bureau of the Census, Dept. of Commerce.

Fig. 4. Production in Four Important Industries

A comparison is shown in the following table:

	R. R. Tonnage	Prod. Basic Indust.	Prod. Manuf. Goods
Sept. 1922	108.6	124.2	116.8
Aug. 1923	136.9	149.3	126.9
Sept. 1923	126.5	141.7	121.1
Oct. 1923	125.6		

Stocks of Important Commodities

Gasoline stocks according to our index, Table 1, have increased 3 per cent. Newsprint paper stocks have declined slightly. Cottonseed oil stocks are relatively low for this time of the year. Automobile tire stocks declined 11 per cent during September, which shows that this industry is gradually beginning to liquidate its great holdings.

Iron and Steel Production

Production. The average daily production of pig iron decreased 2.5 per cent in October from the September level. (See Fig. 3.) Steel ingot production registered a decline of 1 per cent below the September output. When the pig iron production figures are corrected for seasonal variation, however, the decline is 4 per cent. The actual figures of the production of pig iron and steel are (tons):

	Sept.	Oct.
Pig Iron. Avg. daily	104,184	101,586
Steel. Avg. daily	132,500	131,400

Unfilled Orders. Unfilled orders of the U. S. Steel Corporation as of October 31 were about 93 per cent of the September 30 total. This decline is the same as that between August 31 and September 30. The figures were: September 30, 5,035,750 tons; and October 31, 4,672,825 tons. The unfilled orders of 110 merchant pig iron furnaces were 736,358 tons, the lowest that it has been since January 1919 (as far back as the figures are available), with the exception of November 1922.

Pig iron at Buffalo has been sold at $19 recently, which means that the real price at Birmingham is closer to $18 than the published one of $19, due to the differential between these two markets. Steel prices are holding up better. The *Iron Age* composite steel price has been the same for the past eight weeks.

Conclusion. Our forecast of lower pig iron prices made last month has been verified. The stocks of pig iron are larger now than they have ever been at any time since January 1919, as far back as the data are available; while the unfilled orders are low. In view of this situation we feel confident in predicting that *the bottom of the market will soon be reached. Steel is steady at the prevailing prices and new orders are increasing.*

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
(Index Numbers: Average for 1921 = 100)

Month and Year	Gasoline*	Leather (Cattle)	Zinc	Newsprint Paper	Automobile Tires	Raw Sugar	Cotton-Seed Oil
	100 = 630,757,000 gals	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,000 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs
Jan. 1921	89	100.7	52.2	82.5	126.2	55.9	107.4
Feb	93	102.5	98.4	108.0	121.9	54.5	114.1
Mar.	92	102.1	101.1	130.5	119.0	86.1	140.9
Apr.	92	102.5	104.9	139.3	105.3	76.8	144.2
May	104	100.8	103.1	117.0	103.7	164.7	146.0
June	103	104.4	108.4	104.0	102.0	196.5	130.8
July	109	100.5	116.4	88.7	95.2	170.0	117.3
Aug	108	99.5	119.7	85.0	89.2	106.1	89.4
Sept.	109	99.5	112.1	90.4	90.2	97.4	61.0
Oct	102	96.4	105.1	100.8	76.6	93.8	34.2
Nov.	102	95.9	91.7	76.7	81.2	48.9	46.0
Dec	103	95.2	86.8	77.1	89.6	48.9	74.2
Jan 1922	110	98.5	78.5	79.8	84.7	27.5	101.2
Feb	110	99.0	85.1	88.5	95.6	46.7	107.7
Mar.	110	100.7	83.1	92.7	107.5	116.1	113.3
Apr	110	95.4	78.1	93.9	118.8	202.2	117.3
May	111	101.5	67.0	82.9	125.2	197.8	118.7
June	114	101.6	52.3	82.6	126.6	179.5	99.8
July	123	98.3	38.3	77.9	115.5	166.8	82.7
Aug	133	97.4	37.1	70.5	110.8	208.5	64.4
Sept.	146	91.5	28.0	66.3	106.1	148.0	41.7
Oct.	161	90.2	24.4	62.7	105.7	99.0	20.8
Nov.	160	87.7	23.4	65.8	107.3	19.6	22.6
Dec.	156	85.9	25.3	65.4	113.8	28.2	36.8
Jan 1923	156	85.3	23.6	64.0	105.4	15.8	57.0
Feb	154	84.0	21.5	76.7	107.6	40.2	77.1
Mar	162	82.6	14.1	77.3	119.7	73.4	88.6
Apr	164	81.6	13.0	67.2	129.9	184.3	93.9
May	173	81.4	11.6	62.9	139.3	211.1	92.3
June	174	82.1	16.9	60.5	159.6	166.6	87.2
July	185	82.8	22.2	65.0	161.4	151.0	75.1
Aug	199	83.6	27.5	74.0	118.0	118.8	54.0
Sept	206	84.3	31.4	85.5	138.5	91.6	27.0
Oct.		81.2	29.6	82.2	123.2	105.3	
Nov			33.4				

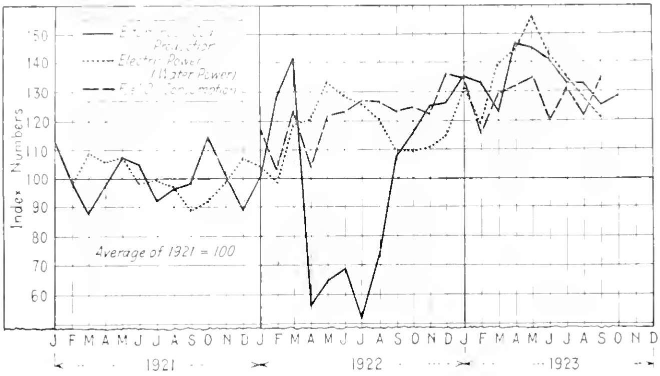
*Last of month; adjusted for seasonal variation

Production in Important Industries

Copper and Paper. The index of copper production, Fig. 4, has declined slightly, from 333 for August to 318.5 for September. There has been a slight rise in the price of copper lately, but no real upswing is evident in view of the great stocks and continued high rate of production.

Paper production for September showed a decrease of 13 per cent from the August level of production.

Wood and Cotton. Wool consumption during September was $3\frac{1}{2}$ per cent lower than during August.



Sources, Department of Interior; Bureau of Mines; United States Geological Survey

FIG. 5 FUEL AND POWER PRODUCTION

is usually the same in October as in September, with the October figure about 4 per cent below the year's average.

Contracts Awarded. There was a great increase in the floorspace of contracts awarded during October. The September index was 98, while that of October rose to 152, a rise of 55 per cent.

Business and industrial building, however, showed a decline of about 3 per cent, and the increased activity was mainly in residential construction. This is an important consideration for, *as long as industrial and commercial building is declining, no decided recovery is likely in the iron and steel industry.* Prices of other building materials will remain high, however, and probably the same is true of wages in the building trades. Recent demands for increased wages in certain sections are ominous.

The consumption of cotton during October was about 12 per cent greater than during September, but after allowing for seasonal variation, the increase is only 3 per cent. Prices of cotton textiles have been rising since August and the industry is in a somewhat better situation now than it was six months ago.

Fuel and Power

Coal. The bituminous coal production index for October, in Fig. 5, shows a slight increase over September, after allowance is made for seasonal variation. Bituminous coal is in ample supply, with prices near the bottom.

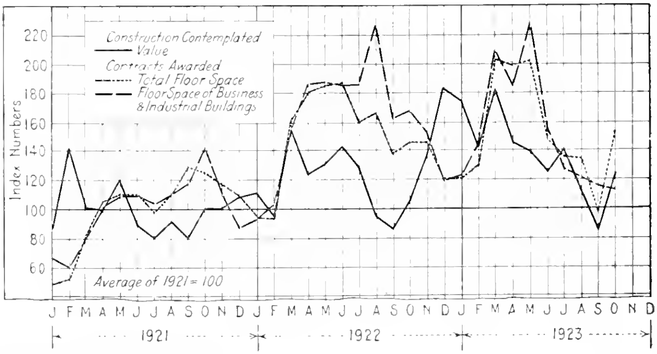
Fuel Oil. Fuel oil consumption during September was 10½ per cent greater than during August, which shows renewed activity in industries using fuel oil. Nevertheless the stocks of fuel oil increased about 1 per cent during September.

Hydroelectric Power. The index of the production of hydroelectric power shows a decrease of 7.5 per cent during September from the August level, but this fall is practically all seasonal in character.

Building Activity in October

October indexes of building activity, Fig. 6, have shown some decided changes from those of September, according to the reports of the F. W. Dodge Company. *The value of contracts awarded rose 25 per cent, although normally October is only 7 per cent greater than September.*

Contemplated Construction. Contemplated construction showed a decided reversal of form for this time of the year. The index rose from 86 to 123, an increase of about 43 per cent. This item



Source, F. W. Dodge Company

FIG. 6 BUILDING CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

Trend of Trade and Finance

Trade Begins Upward Swing: Money Market Easy

Exports and Imports

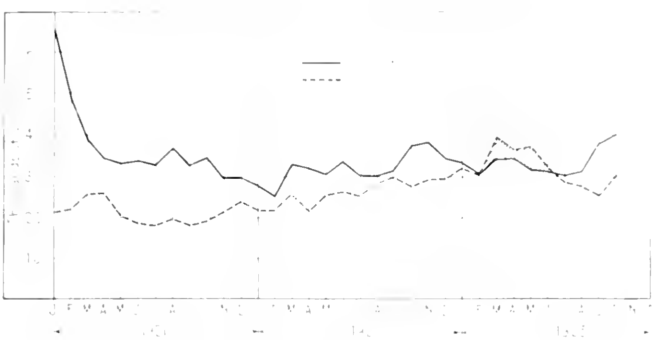
Merchandise imports for October were $303,000,000 (an increase of 23 per cent over September), while exports were $402,000,000 (the highest figure of the year, and an increase of 6 per cent over September). If the merely seasonal trend were eliminated in Fig. 7, however, a different situation would appear: the imports would be well above normal for October, while exports would be less than normal.

The excess of exports over imports of merchandise for the month of October was $99,000,000, bringing the "favorable balance of trade" for the first ten months of 1923 to $135,454,000, against $580,221,000 for the same period last year.

Conclusion. The good gain in merchandise imports is a favorable indication. The small gain in exports was to be expected under existing foreign conditions.

New York Stock Exchange

The average weekly quotations for 50 stocks jumped from 78.35 for the week ending October 27, to 81.36 for the week ending November 10. The upturn in the stock market as shown in Fig. 8 was as forecast in these pages two months ago, and it is confidently expected that the November market will show the greater strength which was predicted last month. There has been *a notable increase in the volume of trading on a rising market which indicates a real upturn in security values. Rising prices alone are rarely very significant.*



Source, U. S. Department of Commerce

FIG. 7. FOREIGN TRADE OF THE UNITED STATES

Bank Debits and Postal Receipts

Bank Debits. The index of the average weekly debits to individual accounts, Fig. 9, reported by nearly 250 centers, after allowance for seasonal variation, was 111.8 for the month of October, against 114.5 for September. This means that the upward movement of the previous month was not sustained. The unadjusted weekly average in October was about 9 per cent greater than in September and 3 per cent below October of last year. Debits for the first week in November were slightly above the average for October.

Postal Receipts. Postal receipts for 50 selected cities during October showed a gain of 17 per cent over September (a month with 5 Sundays). After allowing for seasonal change, the month still showed greater activity than September. In other words, the usual seasonal advance was more than equaled.

Conclusion. Considered together these two indexes show practically the same level of activity as they did in September. In that month the bank debits figure increased while postal receipts fell off. In October they changed direction, the postal receipts index taking the lead. *The bank debits index reflects the "spotty" condition of business during October, and its gain in early November indicates the recent improvement.*

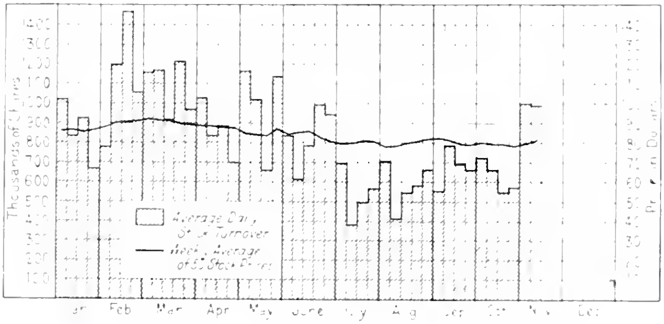
Retail Trade

Mail Order Sales. October sales of Montgomery Ward were in excess of $15,000,000, the highest monthly sales on [illegible] Sears, Roebuck [illegible] $22,7[illegible],000 [illegible] [illegible] 1923 [illegible] [illegible] [illegible] Fig. 10. October 1923 [illegible] pace. Present indications are [illegible] both November and December will [illegible] tinue it.

Department Store Sales. After eliminating seasonal variation, the volume of department store sales for September, as reported by the Federal Reserve Board, showed a 2 per cent decline from August. As measured by the adjusted index, August has been the highest month so far this year.

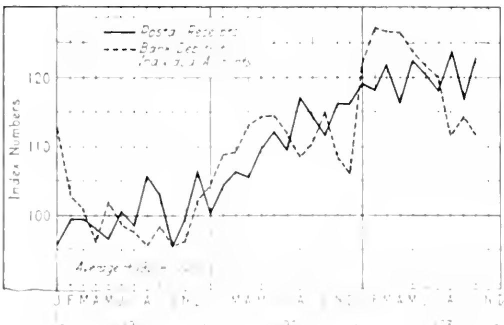
Chain Store Sales. Each of the four chain store systems included in the index showed an increase in sales for October. After eliminating seasonal movement it is apparent that October sales were 4.3 per cent above September and were greater than in any month since June.

Conclusions. The volume of retail trade continues at a high level. Latest reports strengthen the expectation ex



Source, New York Times

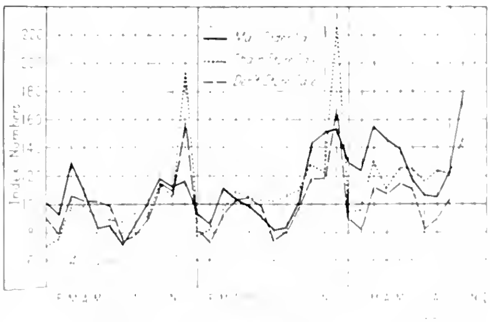
FIG. 8. STOCK TURNOVER AND PRICES ON NEW YORK STOCK EXCHANGE FOR 1923



Sources, Federal Reserve Board; Post Office Dept.

FIG. 9. BANK DEBITS AND POSTAL RECEIPTS

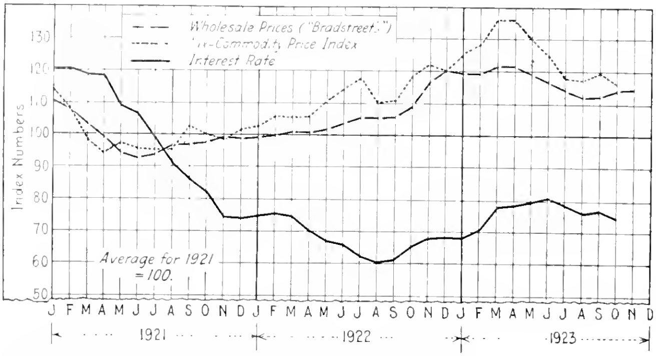
Both curves corrected for seasonal variations.



Sources, Commercial and Financial Chronicle; Federal Reserve Board

FIG. 10. SALES OF MAIL ORDERS, CHAINS AND DEPARTMENT STORES

2 Mail order houses; 4 chain stores; 306 department stores



Sources, Commercial and Financial Chronicle, Federal Reserve Board

FIG. 11 WHOLESALE PRICES AND INTEREST RATE
Interest rate is the monthly average, corrected for seasonal variation.

pressed last month that 1923 totals will surpass those for 1922 and 1921. It is clear that consumer demand is gaining again after a small setback.

Prices and Interest Rate

Prices. During October there was an irregular advance in the average of wholesale prices and the Bradstreet's index on November 1 was 0.3 of 1 per cent over the October 1 level. The six-commodity index, which is the average for the month, fell in October to 116.2 from a September level of 119.6.

Interest Rate. The interest rate on commercial paper averaged about 5.25 in September and fell to 5.15 in October. The adjusted index shown in Fig. 11 declined from 76.7 to 74.8, the average for 1921 being 100.

Conclusion. The outlook is for irregular stability in prices with the general tendency upward, and for easy money. These two facts taken together make it clear that no depression is in sight.

Failures and New Enterprises

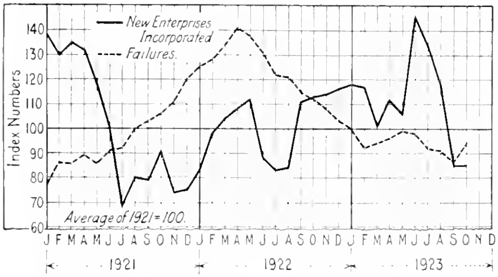
Fig. 12, which shows indexes of the three months' moving averages of failures and new enterprises, indicates that conditions are still unsettled. The failure index rose in October; and, while the volume of new business enterprises incorporated increased, the gain was not enough to be reflected in the three months' moving average. The latter figure, however, suggests a *turn to increased hopefulness concerning the future of business.*

Bank Credits

Loans and Discounts. Total loans and discounts of the 770 reporting member banks of the Federal Reserve System were $11,943,434,000 on October 31. (See Fig. 13.) This was a gain of 0.5 of 1 per cent over the previous month, 6 per cent over October last year, and is the highest figure reached since May 1921. From March to September of this year loans and discounts were practically stationary. September started the upward movement. October continued it.

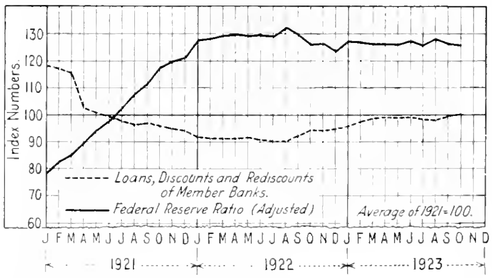
Federal Reserve Ratio. After correcting for seasonal variation, the October ratio of reserve to deposit and federal reserve note liabilities combined fell less than 1 per cent, thus repeating the performance of September. The adjusted ratio for October was 76.0, against 76.5 for September. December is normally the low month of the year. It is expected that the ratio will show some further slight declines before the end of 1923.

Conclusion. The net change in these two indices from those of the month previous is slight. The little change they do show, however, *indicates continued expansion of business.*



Sources, Dun's Review; N. Y. Journal of Commerce

FIG. 12 BUSINESS FAILURES AND NEW ENTERPRISES
Adjusted for seasonal variation; 3 months moving average.



Source, Federal Reserve Board

FIG. 13 BANK CREDIT AND FEDERAL RESERVE RATIO
Federal Reserve Ratio is ratio of total reserves to note and deposit liabilities.

Wage and Employment Situation

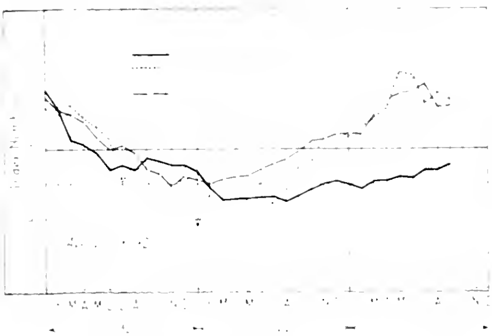
Wages Maintain a High Level: Employment About Stable

Earnings and Cost of Living

New York Factories. The adjusted index of average weekly earnings in New York State factories, Fig. 14, shows a slight rise in September, following the drop which occurred in August. The index now stands at 106.1 based on the average of 1921 as 100.

Wisconsin Earnings. In this state earnings in September were 105 per cent of the average monthly earnings in 1921. From August to September the index adjusted for seasonal variation dropped from 106.5 to 105; the actual average weekly earnings, however, remained unchanged.

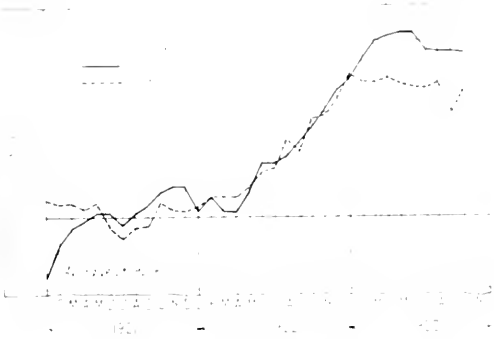
Selected Industries in the United States. The curve of average weekly earnings throughout the United States is not corrected for seasonal variation. This curve fell 1 per cent to 107.1 in



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dept. of Labor; National Industrial Conference Board

FIG. 14. WAGES AND COST OF LIVING

New York factories curve corrected for seasonal variations.



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dept. of Labor

FIG. 15. THE TREND OF EMPLOYMENT

New York curve corrected for seasonal variations.

September. In most of the industries analyzed there were slight increases in average weekly earnings; but rather abrupt drops in the earnings of workers in the car building and repairing, cotton manufacturing, and iron and steel industries, which are heavily weighted in computing the average, caused the decline.

Cost of Living Increases. The index of the cost of living as reported by the National Industrial Conference Board increased from 97.1 to 97.7 from August 15 to September 15 (on a scale in which the average for 1921 = 100). This rise was due to the advance in the prices of food and clothing. The cost of living index of the Bureau of Labor Statistics which is computed quarterly stands at 172.1 per cent above the average of 1913 as compared with 169.7 per cent in June.

Conclusion. The continued narrowing of the margin between wages and prices is favorable to business. The purchasing power of labor has been diminished, but it remains very high.

The Employment Trend

New York. There was a gain of over 2 per cent in the adjusted index of employment from September to October as shown in Fig. 15. Important increases were noticeable in almost all of the metal trades and in the chemical industries, while the usual seasonal increases occurred in the clothing and food products industries.

Wisconsin. For Wisconsin the latest available figures on employment are for September. In this month the seasonally adjusted index declined from 136.2 to 131.1. A decrease occurred in the actual working forces of every classification except the leather industry, which showed no change.

United States. The curve indicating employment in the United States declined slightly. When adjusted to allow for seasonal variation, the index shows a drop of about 0.5 of 1 per cent in October. In spite of this, however, the October report of the United States Department of Labor was encouraging. Eight of the fourteen basic industries reported increased employment, against only five in September. Nearly one-half of the cities reporting showed increases in employment, and Department of Labor states that instead of a slight decline in the actual volume of employment, there would have been an increase noted had it not been for the temporary closing of a number of the large New England textile mills.

Conclusion. From an analysis of the various reports on employment conditions it is impossible to say that there is a pronounced trend either up or down. However, it is clear that *employment continues at a high level.*

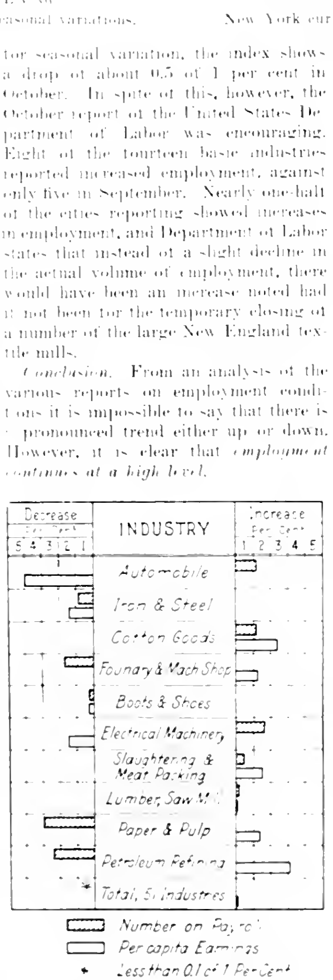


FIG. 16. TREND OF EMPLOYMENT AND EARNINGS, SEPTEMBER 1923

Employment and Earnings in Selected Industries

Fig. 16 shows graphically the trend of employment and earnings in the 10 leading industries of the United States.

Employment. In September the following leading industries showed increases in employment ranging from 1.6 per cent down to 0.2 of 1 per cent: electrical machinery, automobiles, cotton goods, slaughtering and meat packing, and lumber sawmills. Decreases ranging from 3 per cent down to 0.9 per cent occurred in paper and pulp, petroleum refining, foundry and machine shop products, iron and steel and boots and shoes.

Per Capita Earnings. In six of the 10 leading industries the per capita earnings of workers were larger in September than in August. These are: petroleum refining; cotton goods; meat packing; foundry and machine shop products; paper and pulp; and lumber sawmills. The increases range from 3.1 per cent in petroleum refining down to 0.1 per cent in sawmills. Decreases in per capita earnings occurred in the automobile, electrical machinery, iron and steel, and boot and shoe industries.

For the total of 51 industries both employment and earnings were practically unchanged, there being a very slight decrease in employment and a slight increase in per capita earnings.

Immigration and Emigration

The figures on migration continue to show an increase in immigrants, while in August emigration fell off appreciably. A still larger net gain occurred in August than the increase recorded for July. The figures are:

	July	*August*
Immigrants	85,542	88,286
Emigrants	8,041	6,489
Net gain	77,501	81,797

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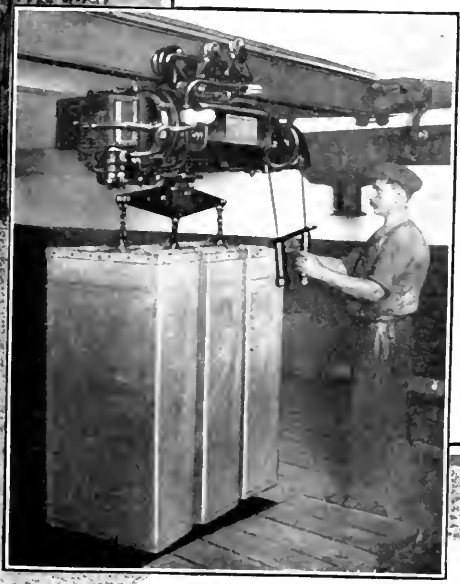

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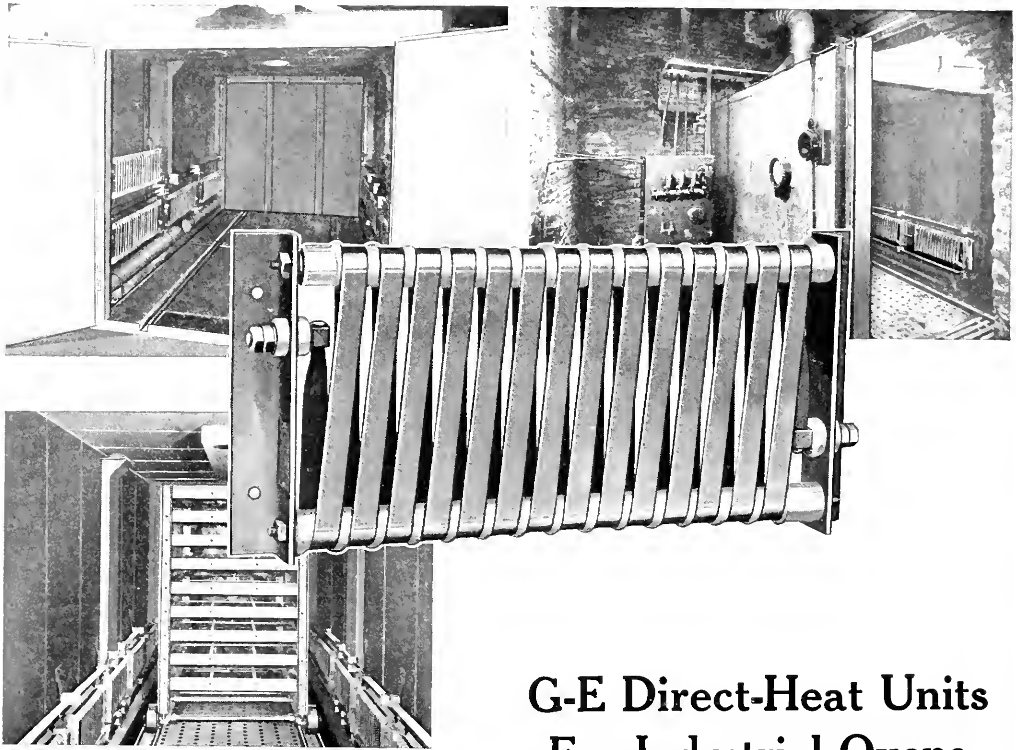


MANAGEMENT AND ADMINISTRATION

FOR OFFICERS EXECUTIVES AND DIRECTORS OF INDUSTRY

MEN MATERIALS MACHINES

VOLUME VI DECEMBER, 1923 NUMBER 6

Capital Requirements and Control

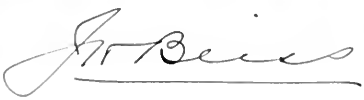
Accounting as an Aid to Executive Control—Article One

By J. H. BLISS

Controller, Libby, McNeill and Libby

Index Number
657.524 Cost accounting
657.7 Public accounting

THE real function of accounting work is to render a service to management. This service lies in placing before the management of a business the most complete information as to its affairs, analyzed and interpreted so as to be readily understood—information that can be used effectively in guiding and controlling the operations and transactions of the business so that these are more profitable, economical, and conservative.



As business organizations grow larger and operations become more diversified, their executives must necessarily place greater dependence upon accounting services. In smaller businesses, supervision is usually obtained through the direct contact of the owner with all the details of the business, but in larger organizations this type of personal supervision is impossible. As responsibility for the affairs of a business is delegated to department heads and operating men, accounting statistics should afford the management the means of supervision and the basis whereon accomplishment may be judged.

Managers should appreciate more fully the great advantage in the use of properly prepared reports and reliable statistics bearing on business operations. This advantage is twofold:

1. The use of reports and statistical information enables department heads and operating men to guide and control their operations more intelligently.
2. The use of reports and statistics by the management provides an incentive to the accounting staff, and at the same time is a check on the usefulness and accuracy of its work. The preparing of such information should be encouraged.

There can be little question but that the executive who is best informed is in the best position to manage his business profitably. The use of well-developed accounting statistics is the only practical means the executive has for maintaining a close contact with the voluminous transactions of the larger organizations.

In the use of reports an executive finds a check on both his ideas and the accounting work. For instance, if a report is a surprise to him, whether favorable or unfavorable, it means that either his ideas or the accounting statistics are wrong. On the other hand, if the report confirms his impressions, obtained through intimate daily contact with transactions, there is fair assurance of the correctness of both the report and the information upon which the executive is operating.

Co-operation between management and accounting forces is essential to the development of the most beneficial accounting service. The undertaking must be a joint effort; the responsibility rests jointly on the accounting and management forces. Full value is realized out of accounting work only as the statistics and reports produced are useful and are used in the conduct of a business. Only on this basis can an organization realize value out of its accounting and clerical costs.

Accountants should accept a broader conception of the functions of accounting. The beginning of accounting service lies in proper account keeping. The end and ultimate object in all accounting work is found in the interpretation of statistics and accounting data for the use of executives. The task of the accountant is not finished with the delivery of a report. His responsibility must necessarily carry to the actual delivery of his services, in such shape that the executive may realize the best information from the statistics.

The frequent statement that many business men do not understand statistics or accountants' reports, only emphasizes the importance of this delivery of analyzed and interpreted accounting information. Any accountant engaged in either public practice or industrial work would severely criticize an organization for lack of attention to orders from customers, delayed or incorrect shipping, or incorrect statements to customers. These are all matters of service, entirely distinct from the question of quality of product. The same situation obtains with the work of the accountant. Beyond the quality of his accounts and reports there is the service to be rendered in making delivery of information to those who should use it.

The viewpoint of the accountant should, at all times, be that of the proprietor or executive of the business. The value of the service which an accountant may render to an organization is largely dependent upon the breadth of his viewpoint, the grasp he has of the business, and the requirements of its executives. He should feel a proprietary responsibility and, as stated, look at the business from the proprietor's viewpoint. He may note from the records of transactions as they pass before him, the points which should be of importance to the management. Such things as volume of business, margins of profit, costs, expenses, turnovers, measures of operating efficiency, working capital position, financial and general trends, all are points to be read out of the accounting statistics of a business. The accountant must necessarily adopt the viewpoint of the manager or proprietor as he studies the records of business transactions passing before him from day to day; and he should be ever watchful for unfavorable trends and unsatisfactory results, and these, when discovered, should be analyzed and pointed out to the proper parties for review and executive action.

Standardization of Financial Reports

Great improvements and advances in accounting practice have been made in recent years, but there are still large possibilities of more uniform application of sound business and accounting principles. A review of the published reports of representative corporations cannot but impress one with the considerable lack of application of recognized principles in the preparation of such reports. One notes from a review of the reports appearing in newspapers, financial journals, and manuals, wide differences in the classification of accounts and methods of preparing statements. These are differences which must affect the conclusions drawn from the statement by various readers. It must be admitted that many statements are presented in such form that sound analysis is practically impossible. So—conceding great advances in accounting practice in the last decade—there is still an actual need for better recognition of basic accounting principles in the preparation and presentation of financial reports.

Public and Industrial Accounting

The accounting services available to the business are of two distinct types:

1. Those rendered by public accountants.
2. Those rendered by the accounting officer or accounting department of a business organization.

It is necessary to make this distinction because of differences in the functions of each, the responsibilities accepted, and differences in types of services rendered.

The services of public accountants include audits of various types, investigations, system work, advisory and consulting services. The services most commonly rendered to the average business man are audits and system work. Investigations are also frequent in connection with reorganizations, issues of capital securities, etc. The field for consulting or advisory services is as yet little developed, though it should become one of the most important of services rendered by public accountants.

The services of the industrial accountant attached to a business organization are by far the more important. They are and should be the real accounting service to management. The scope of such services should be recognized as including not only the direction of accounting procedure and preparation of reports and statistics, but also as stated before, the analysis and interpretation of accounting statistics to executives, managers, and department heads.

The work in both of these fields of accounting services in the past has been largely confined to matters of technique and procedure. It is the writer's opinion that the greater future development in both fields should be in the analytical and interpretive work, calculated to make delivery of more valuable and effective services.

The viewpoint from which the present series of articles is written is largely that of the industrial accountant. Particular emphasis is placed on the work in this field for the reason that opportunities for development are larger, and further, because the work done internally by an accountant or staff, constitutes the more important services of accounting to a business.

The services rendered by public accountants are usually divided into the following types or classes:

1. Auditing services.
   (*a*) Cash audits.
   (*b*) Balance sheet audits.
   (*c*) Detailed audits.
2. Investigations, such as for the purchase or sale of a business, reorganization, issues of capital securities, lines of credit, etc.
3. System work.
4. Advisory or consulting services.

Let us first consider the character of each of these types of undertakings. Cash audits contemplate only the verification of cash transactions. The scope of the undertaking is so limited and the purposes so well defined that little consideration need be given this particular class of work.

Various Types of Audits

The balance sheet audit undertakes the verification of the financial statement of a business at its closing date, and is generally reported in the form of a certified balance sheet. Upon the conclusion of a balance sheet audit the accountant should be in a position to submit a very comprehensive analysis of the financial position of a business and the general trend of its affairs.

The detailed audit contemplates a complete verification of the accounts for the period under review. It should present a balance sheet, an income statement, and such supporting statistics as may be appropriate, together with a report analyzing and interpreting these statements. In connection with the detailed audit the accountant has ample opportunity to study the business and should present a very comprehensive review of the company's financial position, its operations, results, and tendencies.

Investigations performed by public accountants are generally undertaken for some specific purpose, such as the purchase or sale of a business, reorganizations, issues of capital securities, etc. In this class of service the accountant is limited only by the purpose of his undertaking. It is probable that more effective services are rendered in this class of work than in any other branch of public accounting.

Contact Between the Accountant and the Management

System work offers great possibilities for constructive services. In this class of work the public accountants, while temporarily attached to the business organization, enjoy more of the contact and relationships of the company accountant. In carrying out this type of work the accountant must develop a very close contact with the management and operating forces, and has unlimited opportunity to obtain the viewpoint of the management, to determine what statistics would be most useful, to design the forms in which statistics may be most effectively presented, and to develop fully the analytical and interpretive services which should be rendered.

The field of advisory or consulting services is developing noticeably and has unlimited possibilities. There are many advantages to an organization in having its affairs considered by one generally informed about the business, but judging it from a more or less detached viewpoint. Large organizations maintain well-developed accounting staffs and are in a position to avail themselves of the services of able accountants who give a large portion of their time to the study of the general affairs and trends of the business. Smaller organizations, however, are not usually in a position to maintain an expensive accounting staff, and would find very advantageous [illegible] accounting services of a [illegible] informed [illegible] a periodic [illegible] This is the most [illegible] accounting [illegible] for a small or [illegible] and should produce the most [illegible] It is better that the periodical [illegible] of the continuity of service.

There are large possibilities [illegible] development in the services rendered by public accountants. In all auditing there is so much detail [illegible] of checking and analysis of accounts, and so much study necessary that it is to be regretted that the average auditor does not include in his report more useful information which could be readily and effectively used by the client. It is recognized that the requirements of different concerns must be taken into consideration; that in many cases the opportunities are limited because the scope of the engagement is restricted. Also, from the viewpoint of the accountant it must be recognized that the scope of the work undertaken should be clearly defined, and of course he cannot accept responsibility for accounts of which he knows nothing. No suggestion should be countenanced which tends to impeach the integrity of accountants' reports, for therein lies their greatest value. But beyond these considerations, business should expect, and accountants should render, more useful services as a result of the customary auditing procedure.

Public Accountants' Reports

The presentation of well-analyzed and interpreted information in accountants' reports is so important a matter that it is worth while emphasizing at greater length. Following are some of the points which might be developed in connection with balance sheet and detailed audits, in addition to the routine information usually reported. It is appreciated that all of these points might not be applicable to any particular undertaking. However, they will serve to illustrate the type of information which would be more useful in business management.

1. The financial position of the business as shown by its balance sheets should be carefully and thoroughly analyzed, so as to develop all of the important ratios, relationships, and turnovers. This information should be explained to the full understanding of the client. While a balance sheet audit may not undertake the verification of sales or other income and expense accounts the auditor should easily satisfy himself that the available figures are sufficiently sound to warrant their use in developing the financial and operating ratios.

2. The income statement should be carefully analyzed and all of the fundamental ratios and relationships developed and fully explained. The aim should be to develop in the audit report all of the useful business information possible, and to convey this to the executive in his own language and terms, in such manner as to be fully understood.

3. The financial statements over a period of years should be carefully studied. Few business men give as much attention to the trends and tendencies of a business as they should in laying out policies for the future.

Changes in conditions within a business come more or less slowly. The trends may be noted from a study of analyzed statistics, and, in many cases, unfavorable tendencies may be corrected by prompt attention. If, however, these are neglected they might ultimately become serious matters.

4. The relationships and conditions existing in a business should be analyzed and compared so far as possible with competitive business standards. The public accountant should be in a position to give valuable suggestions to the client in this respect, without violating the confidence of any other client.

5. Conservatism or the lack thereof should be noted in the financial management of the business. Policies for development of fixed properties, the protection of working capital position, the disposition of profits left in the business, and all factors leading to continuous and conservative development, should have careful consideration.

6. The comments made and the statistics presented should carry to the client a comprehensive survey of the business from both the operating and financial points of view—in short, his point of view. Qualification of statistics used should be made where necessary, but when satisfied that accounts are substantially correct the accountant should use them in developing as complete analyses as possible. Only on this basis is it possible for the accountant to render the most effective services.

Services Rendered by Industrial Accountants

The responsibilities of the industrial accountant attached to an organization, usually include:

1. The development of a proper system and classification of accounts, making such changes and improvements in them as appear advisable from time to time.
2. The operation of the accounting procedure; that is, direction of the accounting forces and work in such manner that adequate reports and statistics are produced.
3. The transmission to the managerial and operating forces of statistics and information developed from the accounts in such shape that they may be most conveniently and effectively used.

Each of these three responsibilities of the industrial accountant is important. In some organizations the work is apportioned to the staff along these lines, certain members specializing in each branch. This division in accounting work may be compared to the several functions in a manufacturing business, where there is buying, manufacturing, selling, and delivery. Each division of the organization must function properly and effectively if a continuous and satisfactory business is to be maintained. Attention to orders of customers, prompt deliveries, and minimum amount of errors in shipping are all elements of service, and are like similar elements entering into the services the accountant should render in making delivery of his product.

The necessary co-operation between management, operating, and accounting forces must not be overlooked. Satisfactory accounting services may be developed only on the basis of close contact and co-operation between these departments. It is not a one-man job; the responsibilities necessarily rest on all. This co-operation contemplates:

1. That the management require and make use of appropriate accounting data and statistics, and that there is the proper co-operation throughout the organization in submitting to the accounting staff the proper initial records and data on operations and transactions.
2. That the accounting force develop proper accounts and accounting procedure, recognizing sound principles and adapted to the needs of the particular business—and on this basis prepare its reports and statistics, and render services to the management.

Industrial accountants can do much to promote the development of better accounting services within their organizations. They should take the initiative by producing the reports and statistics which are essential, and, by explaining them to those who should use such statistics, develop their interest, and secure the co-operation of managerial and operating forces.

There has been considerable justification for the attitude of some business men that accounting is an unproductive overhead burden which business has to carry. This attitude only indicates that they have not received the best of accounting services and do not appreciate the possible advantages thereof. It is not information in books that is of the greatest value to business; it is not what the accountants may know or see in the reports, but rather the information delivered to and used by the management, that measures the real value of the accountants' services. Accounting and clerical costs are material elements in expenses, from which full value may be realized only as satisfactory information is derived and used in the direction and conduct of the business.

Managerial Requirements

The industrial accountant should be a "self-starter." That is, he should deliver the information his accounts and records develop and should not expect the managers of the business to call for everything they need. As a matter of fact, many of them do not know just what to ask for, and some of them in the stress of daily business are apt to overlook the information which would be of vital interest to them in handling transactions. The accountant sees passing before him in his records the story of the business as it goes on from day to day. It is his responsibility to report the salient points of that story to the management. Statistics and accounting services are not the panacea for all business troubles, but there should be a reasonable use of them in business management. All such information should be presented in a manner to conserve the time of the busy executive.

(Article II—"The Story Told by the Financial and Operating Statements" will appear in the January number of MANAGEMENT AND ADMINISTRATION.)

Operation Control Through a Cost System

Results Secured in Producing Dress-Goods and Cloth

By JOHN L. WALTHER

President, Walther Manufacturing Company

Index Number
657.524 Cost Systems
658.9:677 Textile Industry. Management

> Which of our lines are profitable and which cause a loss? How can we make money on products now unprofitable? What abnormal expense conditions developed last month? What should we manufacture during dull periods actually to reduce losses although we are forced to sell below cost? The answers to these and many similar operating questions are obtained promptly and correctly by Mr. Walther through the cost system in use in his plant.

WE had realized for some time that the cost system which we had been using for several years did not give us accurate figures as to the cost of each line of product which we made. Frankly, we were somewhat skeptical as to whether any cost system would give us accurate costs by lines, for all methods of cost finding about which we knew in the textile industry seemed to rely upon approximations to a considerable extent. However, when a year or two ago conditions became highly competitive, we determined to see whether a method of costing accurately by kind of product, a common procedure in other industries, could not be developed for us. Such a system was installed, and we find now that the methods employed permit us to make use of the cost system for other purposes in addition to that of costing by lines.

We manufacture high-grade dress-goods and cloth for men's wear in worsteds and woolens. Sometimes a month's production will include as high as 500 variations or styles of cloth. Hence, it is easy to see that costing by styles is essential. Under our old plan we were able to develop the cost of material and labor by lines quite accurately. But because we lumped all of the overhead for the plant as a whole and distributed it evenly over the entire production by dividing the total overhead by the total yards produced, there was a serious error in the final costs of all styles. The average method of spreading overhead is hardly ever accurate unless a plant turns out only a single kind and style of product; a condition that exists very seldom in any branch of manufacturing and practically never in any factory engaged in the textile industry.

What we were pleased to call our "cost system" had many faults. Although five men gave part of their time to the records, the records were practically always a month behind, including the general books of account. The cost system did not tie in with the books, we had no balance of stores or perpetual inventory system, no accurate record of production by departments, and no method of accounting for material usage in dollars and cents.

No useful purpose would be served by describing in detail the methods we now follow, even if it were possible to do so in so small a space. However, it seems well to mention the fundamental costing methods we use so that it may be clear how we achieved the benefits that resulted from the system.

The plant was entirely departmentalized into the usual productive and non-productive departments. The production peculiarities of each department were studied very carefully in order to find the best method of spreading the overhead over the product for each case. This is very important. Unless each department uses the best method, correct costs are impossible.

As a result we decided upon the following methods. In the receiving and stores department the overhead is allocated on the basis of the pounds of yarn that go into process. The pounds of yarn wound is the unit for the winding department. An overhead cost per warp is developed for the warping department while a loom-hour cost of overhead is developed for the weaving department. The actual labor is applied directly. Perching, examining, mending, and picking is done in one department, but two methods of distributing are used in order to get the greatest possible accuracy. The labor and expense for perching and examining are distributed on the yard basis, while the expense for mending and picking is spread as a percentage of the labor. (See Figs. 1 and 2.)

The labor and expense of the finishing department are spread on the unit yard basis. The unit yard is determined by tests which show the relation between the consumption of labor and expense and the amount of labor and machine time used in finishing any given piece of cloth. This unit varies for each finish and type of cloth. We believe that this method of allocating the finishing labor and expense is unique in the textile industry, but it is well worth while, for beyond doubt it handles an otherwise difficult bit of accounting very efficiently and accurately.

The finishing materials such as oils and soaps are also distributed on a unit basis. The accuracy of these

WARP COST SHEET

STYLE 4326 — DATE ORDERED 9/15/22

WARP NO. 4963 — PIECE NOS 43724 – 730

LOOM NO.

7 CUTS 60 YDS EACH

ENDS 6624

SELVAGE 90 — 3 red — 3 blue

WIDTH OF LOOM 66

REED 14 x 8

SHAFTS 13 x 2

DRAFT ——

DESIGN 4923

PICKS 58

DRAWER OR TWISTER

DRESSER Sharp

PUT IN DRESSING 9/20/22

CUT IN LOOM — WARP OUT

REMARKS

WARP	Weight Per Cut	Total Weight	Price	Amount
2/32 Khaki Mix				
Estimated Warp Yarn				
Actual Warp Yarn		247	2.05	506 35
4 % Yarn Allowance		9.9		20 30
Warp Spooling & Winding Lab & Exp				
TOTAL WARP YARN COST		256.9		526 65

FILLING	Weight Per Cut	Total Weight	Price	Amount
2/32 Khaki			2.05	
Estimated Filler Yarn				
Calculated Filler Yarn		151	2.05	309 55
9 % Yarn Allowance		13.4		27 47
Filler Spooling & Winding Lab. & Exp.			.14	23 02
TOTAL FILLER YARN COST		164.4		360 04

STYLE 4326 — TYPE OF LOOM — CLOTH CLASSIFICATION

Weaving	Units	Cost	Amount
Direct Labor (M Picks)	11506	933	107 35
Shuttle Allowance (M Picks)			
Drop Wires (M Ends)	6.6	26	1 72
Chain Labor (Bars)	.22	033	66
Expense (Loom Hours)	266	.42	111 72
WEAVING COST			221 45

Drawing-in	Units	Cost	Amount
Direct Labor (P W)	6624	95	6 29
% Direct Handing-in Lab		50	3 15
Total Direct Labor			9 44
% Expense to Labor		70	6 61
Drawing-in Cost			16 05

Warping or Slashing	Units	Cost	Amount
Labor and Expense	1	32.00	32 00
Leasing Labor (M Ends)			
Warping Cost			

	TOTAL
TOTAL WARP YARN COST	526 65
Purchase & Stores Cost (.08¢ per Lb.)	20 55
Warping Cost	32 00
WARP COST	579 20
Drawing-in Cost	16 05
TOTAL FILLER YARN COST	360 04
Purchase & Stores Cost (.08¢ per Lb)	13 15
Weaving Cost	221 45

Item / Piece Number	43724	43725	43726	43727	43728	43729	43730	Detail Totals	Total
Color									
Grey Cloth — Perch Date / Yards	9/26 52	10/1 53	10/6 54	10/7 54	10/9 54	10/12 65	10/14 53½	385 4/	
Grey Cloth — Pounds	71½	73	75	75	74	75	74½	518	
GREY CLOTH COST									1189 89
Burling Labor	85	85	85	85	85	85	85	5 95	
Kinking "									
Mending "	3 86	3 74	3 36	3 60	3 38	4 27	3 51	25 72	
Remending "			86		64	69		2 19	
"									
Specking "	1 27	1 57	2 65	2 76	1 38	2 53	2 53	14 69	
Perch Exam and Sew Labor Cost per Grey Lb $	92	94	95	95	95	96	94	6 61	
Total Direct Mending Labor								55 16	
Expense to Labor 32 %								17 65	
MENDING COST									72 81
Date to Finish, Dye & Re-Dye									

Finishing Labor & Expense per Unit Piece. — Unit 2.02 x Cost per Unit 4.35 = 8.787 Fulling & Scouring Material Cost per Grey Lb. — Unit 80 x Cost per Unit .060 = .048

Item	Detail Totals	Total
Finishing Labor & Expense	61 51	
Fulling & Scouring Materials	24 86	
FINISHING COST		86 37

Dyeing Labor & Expense per Grey Lb. — Unit x Cost per Unit = Dyeing Material Cost per Grey Lb. — Unit X Cost per Unit =

Item	43724	43725	43726	43727	43728	43729	43730	Detail Totals	Total
Dyeing Labor & Expense									
Dye Materials									
DYEING COST									
TOTAL MFG. COST									1349 07
Finished — Date / Yards	50	49½	51¾	51⅔	52¼	52¾	51⅓	359 2/	
Finished — Ounces / Pounds									
MFG. COST PER YARD								Average	3 75
Grade								Shipping	

Total Grey Weight	Finished Oz. per Yard	Finished Width	Selling Price	Commissions, etc.
Total Finished Weight	Standard Oz. per Yard	Standard Width	Less Dis & All. %	Sell Exp %
Shrinkage in Weight %	Shrinkage in Length %	Figured by Date	Net Selling Price	Trading Cost per Yard
			Profit per Yard	

FIG. 1 WARP COST SHEET *(Face and Reverse)*

Warping or Slashing Job *Warping* | Leased *Yes*
Width of Loom *61* | Shafts *14 x 2*
Picks *16* | Drop Wires *6.7* | Bars Chain *20*
Kinked *No* | Specked *Yes* | Finishing Group *B-2*
Est. Grey Wt *518* | Est Grey Yds *376* | Est Fin Wt.
Est Fin Yds *360* | Less % Allowances | Net Est Fin Yds.
Weave Similar to *3622*
Finish Similar to *3622*
Colors to be Estimated

WEAVING & FINISHING		UNITS	COST	AMOUNT	TOTAL
Estimated Warp Yarn Cost					757.12
Purchase & Stores Cost		291 2	.075		21.84
Warping or Slashing Lab & Exp				30.00	
Leasing Labor	(M Ends)	6720	40	2.68	32.68
ESTIMATED WARP COST					811.64
Drawing in Direct Labor	(PW)	6720	95	6.38	
50 % Direct Handling Lab			50%	3.19	
Total Direct Labor				9.57	
10 % Expense to Labor				6.70	16.27
ESTIMATED FILLER YARN COST					285.43
Purchase & Stores Cost		1241	075		9.31
Weaving Direct Labor	(M Picks)	13275	966	128.24	
Shuttle Allowance	(M Picks)				
Drop Wires	(M Ends)	67	24	1.61	
Chain Labor	(Bars)	20	022	.44	
Expense	(Loom Hours)	368 0	420	154.56	284.85
ESTIMATED GREY CLOTH COST					1407.50
Mending Burling Labor		8	85	6.80	
Kinking Labor					
Mending Labor		376	089	33.46	
Specking Labor		8	1.83	14.64	
Bench [illegible]		376	020	7.52	
Total Direct Mending Labor				62.42	
32 % Expense to Labor				19.99	82.41
Finishing Lab & Expense 3.05 Unit 4.35 Cost		8	13.26	106.08	
Material .36 Unit .06 Cost		518	0576	23.84	135.92
ESTIMATED FINISHED CLOTH COST NOT DYED					1625.83

Piece Dye Color		206	145	219	320	
Dyeing Lab & Exp	.090	18.81	19.58	19.44	9.71	
Materials	.125	20.06	2? 20	1? 95	8.32	137.67
ESTIMATED MFD CLOTH COST DYED		38.87	42.78	37.39	18.63	1763.50
Mfd Cost per Yd	360 fin. yds					4.[illegible]
.065 % Seconds						.02
Shipping						.05
Commissions	.1065 %					.52
Selling Expense	.0?40 %					.36
Estimated Sold Cost per Yard						5.85

REMARKS

CLOTH COST ESTIMATE

Style No Assigned *3864* *M.A. D.G.B.G.* | Season of *1924*
Coupon Number *2682* | Date Requested *9/10/23*
Estimated Sold Cost | Date Estimated *9/16/23*
Estimated Selling Price | Estimated By *F. J. R.*

BASIS OF ESTIMATE

General Description of Fabric

Warp Ends *6720* Selvage *2L* Yarn Price Schedule *[illegible]*

8 Cuts *60* Yards Each Mfr Lab & Exp Schedule

WARP YARN	Estim. Total Per Cut Weight	Price	Amount
2/40 Worsted White	*[illegible]*	*.280*	*[illegible]*

ESTIMATED WARP YARN
4 % Yarn Allowance
Warp Spooling & Winding Lab & Exp
ESTIMATED WARP YARN COST

FILLER YARN

1/46 Worsted

ESTIMATED FILLER YARN
? % Yarn Allowance
Filling [illegible] Lab & Exp
ESTIMATED FILLER YARN COST
TOTAL ESTIMATED YARN COST

FIG. 2 CLOTH COST ESTIMATE SHEET. *Face and Reverse* units has been proved by checking the actual cost over a period of months with the normal figures. The fact that they agree closely shows that they are practically accurate.

In the dye department we dye both yarns and piece goods. Here we have set up four separate sets of units:

1. For the labor and expense of yarn dyeing.
2. For dye materials per pound of yarn.
3. Labor and material per piece for piece dyeing.
4. For dye material per piece.

These units have also been checked as were the finishing units and have been found to give a high degree of practical accuracy.

The expense for each department is gathered on an expense analysis form such as is illustrated in Table 1. Here are gathered for each department all items that make up the overhead expense. These include the shares of fixed charges, the shares of contributory or non-productive departments, and those items that can indubitably be charged direct to the department, such as foreman's salary, supplies, and so forth.

From experience we set up a normal total expense figure for each department, and each month compare with this the actual total expense. In our business it seems sufficient to make this comparison in bulk; in some businesses, it is undoubtedly worth while to set a normal or standard for each item and make the comparisons in detail.

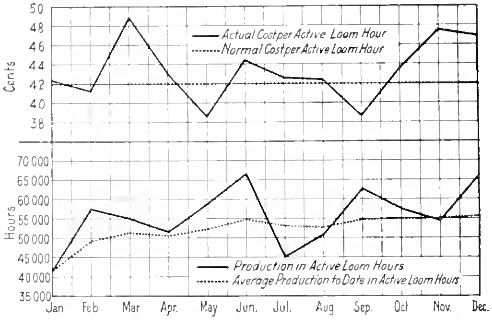


FIG. 3 DEVIATIONS FROM NORMAL OF LABOR, EXPENSE AND MATERIAL

Each month a statement is drawn up showing all deviations from normal of labor, expense, and material for each department. The "exception principle" applied thus to expense items enables immediate action to be taken for the correction of operations which are causing losses. (See Table 2.)

This information is also shown graphically on a chart like Fig. 3. Lines showing the normal expense for each department are first charted. Then each month the actual expense is plotted to show vividly any deviation. The actual overhead to date is also plotted as a check on the consistency of the normals which have been set up.

Our present cost system ties in with the general books of account, which to our mind, is an essential of a good system, without which no accurate check on the costs is possible. In fact, our cost system is essentially a part of the accounting system, and merely analyzes the book figures in such a way as to give certain information called "the cost of the product." We now have as necessary adjuncts to the cost system, excellent perpetual inventory records, a real pay-roll department that gives intelligent analyses of our labor costs, and production records that tell us quickly and accurately what we have made. So much for the mechanics of our cost finding.

All of these are excellent, but of themselves they are valueless unless they help us serve our customers and ourselves to better advantage, and give us better control of manufacturing, selling, and finance. That it has given us this control is beyond question as I shall show.

TABLE 1. DEPARTMENTAL EXPENSE ANALYSIS BY MONTHS
YEAR 1923

Symbol	Dept General No.16 Weaving	For the Month of January			For the Month of February			For the Month of March		
		Normal	Actual	Period to Date	Normal	Actual	Period to Date	Normal	Actual	Period to Date
PR	Overseer	...	$840.00	...	...	$840.00	...	...	$1,050.00	...
	Second-hand	...	360.00	...	...	360.00	...	...	450.00	...
	Filler tender	...	475.05	...	...	432.53	...	...	566.25	...
	Spare hands	...	1,731.30	...	...	1,857.90	...	...	2,464.65	...
	Loom fixers	...	4,108.12	...	...	4,411.20	...	...	5,518.75	...
	General clerk	...	183.30	...	...	205.73	...	...	263.25	...
	Bonus	...	285.68	...	...	420.38	...	...	501.45	...
ER	Electric light bulbs	...	69.94	...	...	72.95	...	...	47.65	...
	Oils and waste	...	32.00	...	...	...	...	...	...	...
	Friction plates	...	...	...	...	...	...	...	...	...
	Pickers, picker sticks	...	130.00	...	...	366.30	...	...	353.10	...
	Shuttles and bobbins	...	447.20	...	...	420.65	...	...	232.70	...
	Drop wires	...	...	...	...	...	...	...	...	...
	Loom parts	...	996.10	...	...	1,140.28	...	...	1,655.43	...
	Maintenance materials	...	259.92	...	...	556.28	...	...	806.55	...
	Miscellaneous supplies	...	52.12	...	...	106.22	...	...	82.51	...
	Printing and stationery	...	...	...	...	...	...	...	...	...
	Small tools	...	...	...	...	...	...	...	...	...
	Reeds and heddles	...	63.30	...	...	42.09	...	...	119.67	...
	Harness straps	...	50.40	...	...	141.87	...	...	48.60	...
	Leather hides	...	81.00	...	...	24.30	...	...	54.00	...
3A	Maintenance charges	...	547.60	...	...	714.03	...	...	1,242.50	...
	Total Direct Expense		$10,713.02	...	...	$12,112.71	...	...	$15,457.06	
FC	Share of fixed charges	...	$2,036.04	...	...	$2,036.04	...	...	$2,545.05	...
1B	Share of boiler	...	463.53	...	...	404.22	...	...	227.01	...
2B	Share of power and light	...	1,269.48	...	...	1,132.36	...	...	1,348.77	...
7A	Share of general plant	...	2,269.12	...	...	1,340.53	...	...	2,485.12	...
8A	Share of general personnel	...	1,288.70	...	...	1,179.00	...	...	1,684.83	...
	Total	...	18,039.90	...	...	18,204.86	...	...	23,747.84	...
9A	Share of general management		6,409.83	...		6,144.90			10,754.46	...
	TOTAL GENERAL WEAVING EXPENSE	...	$24,449.73	...	...	$24,349.76	...	...	$34,502.30	...

Active Loom Hours,	49,977	Active Loom Hours,	48,836.75	Active Loom Hours,	68,159.25
Expense,	$24,449.75	Expense,	$24,349.76	Expense,	$34,502.30

As stated, our original purpose in installing the new cost method was to learn exactly what our various lines and styles of products cost. For example, we formerly had a considerable part of our production tied up on a certain staple line of product that we felt sure had to be sold on a very narrow margin. When the new cost system commenced to function, it showed us beyond a doubt that the margin was not only narrow – it was less than nothing. In fact the loss on that line was so great that we finally discontinued it entirely. We cannot always do that; for in our business it still seems necessary sometimes to sell goods at a loss. We have an advantage now in that we know exactly how much the loss is and can strictly limit the volume of non-profit business that we will take. We also have found that some lines are not so profitable as we had thought, and that some which we thought were profitable actually were sold at a loss. With this information available for all lines, we can intelligently balance our sales and production in such a way as surely to give us at the end of the year the net profits we desire.

This knowledge of costs has its good effects on those who buy from us in that they have certain assurance that our selling prices correctly reflect our costs. Without costs by lines, certain lines may be priced too low – by that the buyer benefits. But other lines which have been made to carry too much of the cost are nearly certain to be priced too high, with the result either that the buyer pays too much or refuses to purchase, and we lose attractive business.

Price Setting

In setting selling prices, the use of normal and abnormal figures is valuable. Every business man knows that to attract business enough to keep his plant going in dull times he must cut prices to a point where all profit is wiped out or an actual loss may result. The idea, of course, is to make it possible to keep the important parts of the organization together, and to get back all of the labor and material cost together with some contribution to that part of the overhead expense which goes merrily piling up whether the plant is running or not.

To set such a price by guesswork is dangerous, for I doubt if any man is so conversant with his manufacturing processes that without cost figures he can hit on exactly the right figures. If the selling price is set a trifle too low the whole end is missed and the losses will be greater than if the plant were closed down.

We have used the normal cost figures developed by our system to good advantage in this way. During a dull spell we tried out one market and found that a price just a trifle below cost would attract enough business on a certain fabric to enable us to turn over one-third of the capacity of our plant to the production of that cloth. This enabled us to get back the overhead of our plant, which would otherwise have been a dead loss, and we were also able to keep our organization complete.

Every textile mill is so equipped that it can turn out certain lines of product to best advantage. Every capable textile man realizes this, but just what the relation is between different lines he cannot tell without accurate figures. We now know this definitely and have changed our policies somewhat to accord with our knowledge.

When conditions force us in normal times to take some business at a loss, the cost system often points the way to changes in manufacturing methods that will reduce the losses, or even actually turn the loss into a profit.

For instance, the minute analysis that we get of all cost elements showed us in one case that by using a more expensive grade of yarn we could actually reduce the final cost of the cloth. This was shown by comparing the cost of material with the labor and expense cost of manufacturing it. The more expensive yarn was so much less expensive to manufacture into cloth that the extra material cost was more than offset by the lower labor and expense cost. This could have been shown only by an accurate and detailed cost system.

Savings Made by Adherence to Formulas

In one department – the finishing department – the system showed up inefficient methods that were rectified, thereby contributing materially toward the cost of installing the new system.

In comparing the actual quantities of finishing materials used such as soap, oils, and so on, with the normals that had been set, we found that there seemed to be no consistency in the amount of these materials used from month to month, even when the various kinds of cloth which had been finished were taken into account. This led us to study the methods in use in the finishing department in mixing the various solutions.

We found that no attention was paid to the established formulas for the solutions nor to the standard quantities of solution to be used for a given amount of cloth. In fact, in some cases no formula had been determined and everything was left to the judgment of the foreman.

For instance, no certain amount of water had been determined upon for a certain yardage of cloth. The amount of water used for scouring was left to a workman. Obviously, the more water that was used, the more soap there was needed to get a proper solution. Even the amount of soap per gallon of water was not determined by formula but was being judged by "feel." This is not only inaccurate, it is practically always wasteful; for to be safe, they never used too little soap, they always used too much. The same thing was found to be true with the other finishing materials.

As a result, we now insist that formulas be adhered to and we carefully check up on our cost records monthly to see that they are. By forcing this department to stick to its formulas we have reduced the consumption of materials sufficiently to make a considerable saving.

For some time we had been dissatisfied with the way our plant was maintained. It did not seem to be kept in as good repair as desirable, but we felt we could not afford to spend more on maintenance. A careful study of the maintenance costs proved that we were not getting full value for the money we were spending. This led us to employ a maintenance engineer. His sole duty is to see that the plant is properly kept up and that the cost of maintenance is kept down to a reasonable figure. Although this has not reduced the upkeep cost, it has given us a greatly improved condition at no greater cost than before.

These betterments that I have mentioned are typical. They show how a cost system points the way to industrial betterments that might otherwise have remained hidden. This feature is, to our minds, one of the most important functions of a cost system.

In addition, it might be well to say that the statement of condition, based on a physical inventory at the end of the first year of operation, checked to within $6000 of the profit as shown monthly by the cost system. The variation was readily accounted for and its relative insignificance is an excellent indication of the accuracy of the system. It is not at all a large variation for a business the size of ours.

Our present system was installed by the staff of Miller, Franklin, Basset and Company. It requires not a great deal more time nor effort to operate than did the old one. The cost system and the general ledger take the full time of three men and half of the time of two others. Where formerly we got no records in less than 30 days, we now get all cost figures, including the analyses of expenses for 23 departments, a statement of profit and loss by lines, and the statements of abnormal costs of labor, material, and expense by departments, all within 15 days after the close of the month.

A summary of advantages shows that:

1. Actual units of cost check closely with normal figures calculated in advance.
2. Monthly departmental expense totals vary but little from predetermined amounts.
3. Abnormal items are brought to the attention of executives monthly on a special report.
4. The cost system ties in with the general books of account.
5. Control of manufacturing, selling, and finance has been established.
6. Price setting has been placed on a sound mathematical basis.
7. Profitable and unprofitable lines are distinctly differentiated.
8. Improvements needed in manufacturing methods are often brought to light.
9. Economy of materials has resulted from cost control.
10. Plant maintenance has developed to an efficient state at no additional cost.
11. Annual statements based on inventory check closely with totals from monthly cost reports.
12. Complete and detailed financial and operating records are available monthly in half the previous time and at little additional cost.

TABLE 2. ABNORMAL SCHEDULE

Month of September

Dept No	Department Name	Basis of Application to Cost of Product	Departmental Productions	Cost Per Unit		Total Cost		Abnormal Cost		
				Actual	Normal	Actual	Normal	Expense	Labor	Material
10	Receiving and stores	Expense per lb. of yarn delivered to process	85,164 lb.	$ 0.0787	$ 0.0800	$ 6,698.66	$ 6,813.12	$ 114.46	....	....
11	Dye house	Labor and expense per unit lb. dyed	44,700 Unit lb.	0.0939	0.0900	4,197.97	4,023.00	*307.62*	$ 132.65	.....
		Dye materials per unit lb	38,654 Unit lb.	0.1260	0.1250	4,869.10	4,831.75	....	.....	*837.35*
12	Spooling and Winding	Labor and expense per lb of 2-ply colored yarns	33,913 lb.	0.1228	0.1220	4,165.41	4,137.39	128.85	*156.87*	......
13	Warping	Labor and expense per unit warp	254 Unit warps.	19.60	20.20	4,977.38	5,130.86	141.03	12.39	....
		Leasing labor per thousand ends.	347 Thousand ends	0.2935	0.3500	101.85	121.45	....	19.60	....
14	Slashing	Labor and expense per unit lb.	37,027 Unit lb.	0.0779	0.0800	2,886.04	2,961.96	54.63	21.29	....
15	Drawing-in	Per cent handing-in to drawing-in direct labor	$1,832.85 (Drawing-in labor)	49.36%[1]	50.00%[1]	908.65	916.42	....	7.77	....
		Per cent expense to direct labor Actual .... $3,251.74 Normal ... $3,507.98	Total drawing and handing-in direct labor	65.00%[1]	70.00%[1]	1,842.62	1,951.98	109.36	....	....
16	General Weaving	Direct drop wire labor per thousand ends	1,365 Thousand ends	0.2386	0.2400	325.70	327.60	.....	1.90	....
17	Plain Weaving	Expense per loom hour	50,914.25 loom hours	0.4140	0.4200	21,078.50	21,383.99	305.49	....	....
		Direct chain labor per bar of chain	18,067 Bars of chain	0.0222	0.0220	402.05	397.47	....	*4.58*	....
19	Mending, perching, examining, and sewing	Direct perching and examining labor per grey yard	$1,066.71 Direct perching and examining labor	0.0135	0.0140	1,440.30	1,493.39	....	53.09	....
		Per cent expense to direct labor	$16,451.45 Department total direct labor	30.65%[1]	32.00%[1]	3,303.70	3,605.94	302.24	....	....
20	Finishing	Labor and expense per unit piece.	3,151 Unit pieces	4.371	4.350	13,772.00	13,706.85	277.17	*342.32*	....
		Finishing materials per grey lb	64,801 grey lb. finished	0.0709	0.0675	4,595.07	4,374.08	....	....	*220.99*
22A	Dress-goods shipping	Expense per finished yard	40,508 Net finished yards shipped	0.0456	0.0500	1,849.00	2,025.40	176.40	....	....
22B	Men's wear shipping	Expense per finished yard	50,960 Net finished yards shipped	$0.0385	$0.0400	1,962.34	2,038.40	76.06	....	....
	YARN USAGE—Delivered to process for dress-goods					192,660.35	193,710.73	....	....	1,050.35
	Delivered to process for men's wear					185,420.65	184,842.90	....	....	*577.78*
						$457,457.34 Actual	$458,794.62 $457,457.34	$1,378.07	*$255.08* Expense Labor	$214.29 $1,378.07 *$255.08*
	Total Abnormal Gain					......	$1,337.28	.	......	$1,337.28

[1] These items bulked by department for greater convenience in handling than if distributed on a unit basis.

Saving Millions by Better Loading

By EDWARD S. EVANS

President, E. S. Evans and Company, Inc.

Index Number
658.6884 Preparing automobiles for shipment
629.113:656 Transportation of automobiles

A COMPARATIVELY small cut in the cost per unit of making or distributing a fabricated product runs into surprising totals when applied to an industry in which large-scale production rules, as it does today in the manufacture of motor cars. It is, therefore, not surprising that the application of scientific methods to the loading of automobiles in freight cars has saved the industry fully $50,000,000 in the past 8 years.

Of this total, approximately $17,000,000 is accounted for by the elimination of damages. Eight years ago, on 500,000 automobiles shipped by rail, claims on account of damaged cars amounted to about $2,400,000 or nearly $5 per car. The total is estimated, as the American Railway Association did not begin to classify automobile claims until 1921; but the figure is generally believed to be correct. Last year 2,000,000 cars were shipped by rail—four times as many as in 1915—but the claims aggregated exactly $893,927, about 45 cents per car shipped as against the average of $5 for 1915. Claims in 1922 were less than 60 per cent of the total for 1921, in spite of materially larger shipments.

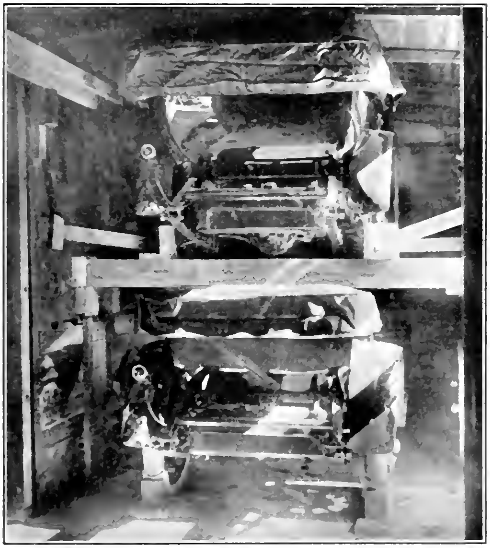


FIG. 1 OLD STYLE DECKING FOR SHIPPING CARS

The saving in freight charges in the 8 years has amounted to about $14,500,000. This is due chiefly to the use of crates that are lighter but stronger than those formerly used, and to economies of space effected through improved methods of placing the automobiles in the freight cars. The problem of getting more automobiles into a car was solved principally by devising a system of "double-decking" (see Figs. 1 and 2). The weight of the perfected decks was only about 225 lb., and the result was a saving in freight rates alone of $10 per automobile on long distance shipments, and approximately twice that figure if lumber and labor are considered. In 1919 this deck was further perfected by an improvement which permitted decking without removing wheels, at an additional saving of 70 cents a motor car. (See Fig. 3.)

We have recently designed, for the export shipping of motor cars, a box which weighs about 200 lb. less than the average export box, but has 25 per cent more strength. A large-scale exporter who tested it and has now adopted it, reports a substantial saving per car shipped abroad over the box previously used, which was designed by his own engineer. We have also succeeded, after long-continued experimentation, in designing an export box which holds two chassis, one which is only 6 in. higher than the old-style single chassis box. (See Fig. 4.)

Loading During the War

Before going further into the details of the improved methods of loading and shipping, the writer will venture to say that his investigations really had their origin in connection with the war. The government was, of course, shipping great quantities of motor vehicles to Europe. It seemed desirable to have the men who did the actual loading instructed in scientific methods, and the writer was called on to place at the disposal of the government his experience in domestic loading. As he could not go to all the camps and deliver the instruction in person he was asked to prepare a "book of specifications." This was later adopted by the American Railway Association with the approval of the National Automobile Chamber of Commerce, and was published with the title "Rules Governing the Loading of Automobiles."

The next development was an appointment to take charge of the crating for all export shipping done by the Quartermaster's Corps. This, as may be imagined, was no small job. We shipped ambulances, water-carts, rolling kitchens, fire-carts, trucks, trailers, and what not. On one contract for horse-drawn rolling kitchens, by re-designing the crate we saved Uncle Sam 22,000 cu. tons, with tonnage at $250 a ton.

With this as a background, we went on to tackle the problem of loading in general. We studied everything we could get hold of that had been written on the sub-

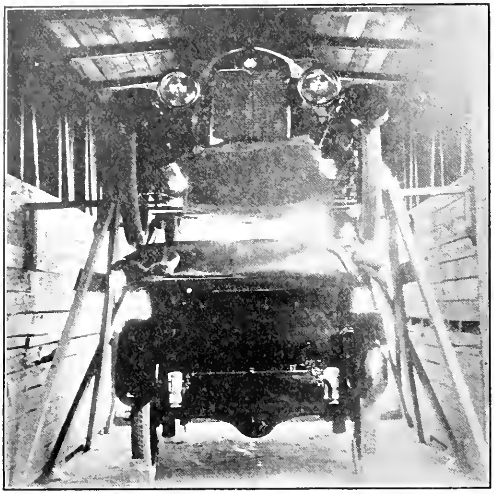


FIG. 2 CARS "DOUBLE-DECKED" FOR SHIPMENT

ject. We secured the co-operation of the Forest Products Laboratory and of others who were studying along similar lines. When we went into loading service as a business we found a fallow field. Every automobile concern was designing and manufacturing its own materials for loading. There were 18 different kinds of loading blocks in use, and none of them efficient.

In the fall of 1915 we invented and put into use what has come to be known as the "Evans block," a solid piece of selected wood, curved and cut to fit the contour of the tire, and with a cut-in heel in the back. We tested this block

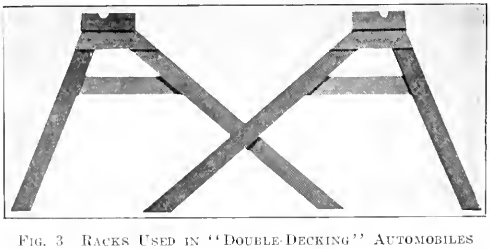


FIG. 3 RACKS USED IN "DOUBLE-DECKING" AUTOMOBILES

in every conceivable way. One series of experiments involved the use of yard-engine, several flat cars, and a stretch of track. We loaded automobiles on the cars, fastened them with loading blocks and then made them "bump the bumps" in every way we could think of. We banged the cars about the yard for hours at a time.

We tested the strength of various kinds of wood for the blocks, and of metal and rope for the "tie-down." The latter, incidentally, had been generally of burlap, with not more than 1020 lb. breaking strength. We substituted metal straps, which increase the tensile strength to more than 4000 lb. On the disc wheel, of course, a strap around the hub or axle is really the only possible method of "tie-down." (See Figs. 5, 6, and 7.)

By means of these tests and experiments we effected a complete change in the nature of our business. We began by selling the manufacturers materials to be used in shipping automobiles. Up to that time no one had seemed to give serious consideration to the mastering of such a prosaic thing as the loading of automobiles on freight cars. But we felt that if we could do it, we would acquire a very valuable sales asset. And that has certainly proved to be the case.

With the information gained from our tests, we were able to qualify as expert advisers in automobile loading, and to deal with the manufacturers on that basis. That the plan has been successful is evident in the face of the tremendous savings in shipping costs.

We have saved a great deal of trouble as well as money for the manufacturers. Freight cars containing automobiles loaded by means of our devices have often been badly damaged themselves as a result of collisions, or of track-jumping, without even marring the finish of the motor cars inside. Freight car doors have been torn away and freight cars themselves overturned without damaging the automobiles within.

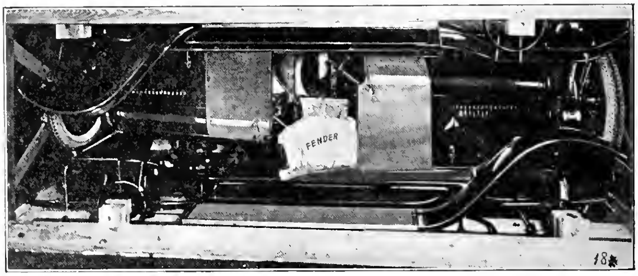


FIG. 4 AN EXPORT BOX WHICH HOLDS TWO CHASSIS

We are especially proud of our contribution to the movement to save lumber, which, fortunately for the future welfare of the country, is gaining great headway just now. In the past three years the lumber saved by manufacturing companies using our devices has exceeded the amount normally found on timber land greater in area than the city of Detroit, which comprises more than 70 sq. mi., or 44,800 acres. Since 1915 we have effected savings equivalent to the production of approximately 83,250 acres of average timber land. And all this is in spite of the fact that lumber is our chief material. We use it for blocks, decks, and export boxes—for everything, in fact, but the "tie-downs," which are of metal or, in certain cases, of rope of great tensile strength.

We manufacture all of our devices used for loading. We buy the timber and cut it to requirements at the source, thus saving the cost of shipping or waste. We are continually scouting for new supplies of timber, in order to keep pace with the phenomenal development of automobile manufacture. The writer only recently made a special trip to Alabama to inspect a proposed site for a new mill for the manufacture of loading blocks. Under this plan of production we are able to deliver finished blocks ready for loading use, at automobile factories, approximately as cheaply as manufacturers could buy rough timber.

Thus far we have considered savings in damages, in freight charges, and in lumber. Another considerable saving has been in labor costs. In 1915 the average time required for a gang of four men to load an automobile was from one to four hours. Today we do the same job, and do it much better, in approximately 15 min., including the removal and fastening of parts. Cars of the Maxwell size, for example, can now be loaded complete six in a car, as compared with five formerly. Automobiles of the Packard size can be loaded five and four respectively, one more than formerly in each instance.

The old method of loading involved the building of a second story or floor in each freight car used for automobile transportation. The carpenters carried sawed lumber, in separate pieces, into the freight car. They then erected staunchions on each side of the car, with cross members on which rested 4 x 6 in. timbers

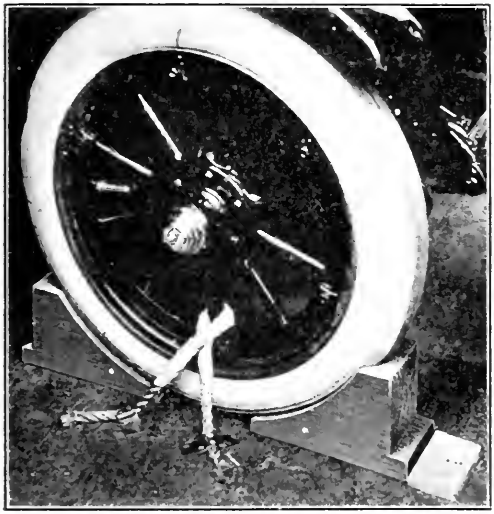


FIG. 5 WOOD BLOCKS AND ROPE USED FOR THE "TIE-DOWN"

numbering four to six per automobile. Upon these timbers rested what corresponded to a floor, consisting usually of two 2 x 12 in. boards, one carrying the left side wheels of the motor car and the other the right. This involved the handling of 44 pieces of lumber, weighing about 750 lb. The building of this deck required the work of five men for two hours.

Loading today is a very different operation. Trusses, somewhat like saw-horses, are built outside the freight car. When the automobile is ready to load, these are brought in: one is placed to the hub of each wheel and fastened firmly to the floor and walls. The whole operation takes from 10 to 14 min.

The development of loading devices made of steel instead of wood is now commanding the interest of

FIG. 6 METAL STRAPS AND ANOTHER KIND OF WOODEN BLOCK USED IN THE "TIE-DOWN"

manufacturers to a certain extent. Since 1918 we have had on our drawing-boards, and in the Patent Office, several designs of steel decks and steel floor loading devices which are probably the "last word" in this character of loading material.

What we call the "Flint device," which is a sort of "glorified hold-down," was invented by Joseph De Frain, foreman on the Buick loading dock, in collaboration with R. B. Steipes. (See Fig. 8.) We bought the patents and immediately began experimenting, changing and developing it until it is today unquestionably the strongest floor loading device in existence.

In connection with this steel hold-down, which involves the use of no wood at all, we made some very interesting tests at the Buick plant in Flint. We loaded, onto a freight car, two automobiles, one with standard wood loading blocks, wood side strips, and heel blocks and wire tie-down, and the other with the "Flint device" or metal hold-down. In order to increase the severity of the test the tires on the second automobile were deflated.

We then shunted the freight car at a speed of 20 miles an hour into collision with two "gondolas" or coal-cars loaded with 55 tons of steel pipe, and having their brakes set. Here was a tremendous test, for the gondolas were almost as immovable as the Rock of Gibraltar.

What happened? The automobile loaded with standard wood blocks and wire tie-downs broke loose. A spoke was torn out of the front wheel. One wooden

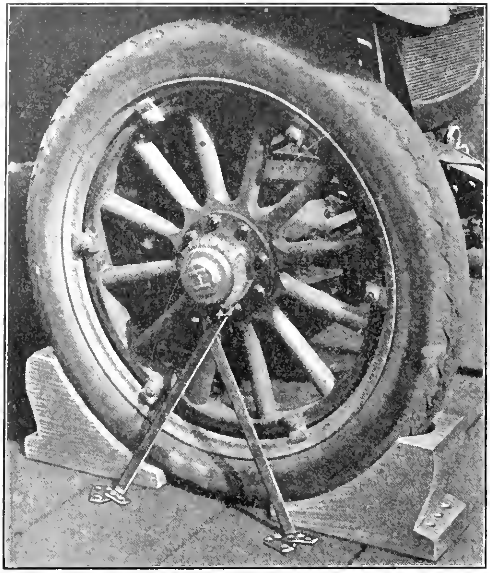


FIG. 7 ANOTHER VARIETY OF "TIE-DOWN"

block, made of long-leaf pine (our best wood for loading block purposes) broke in two. Two others were torn from the floor. All the wire tie-downs were broken, although they were of 2600 lb. breaking strength. Side strips were in splinters. As for the other automobile, loaded with our Flint device, in spite of the tire deflation it was uninjured and all the hold-downs were intact.

Why, then, does the steel hold-down not immediately displace entirely the use of wooden loading blocks? That is a question best answered by our friend, the cost accountant.

The advantages of the Flint device over wooden or steel blocks are these:

1. It prevents tire-chafing, because the hold-down is also a hold-up. That is to say, it is strong enough to take the weight of the car in case the tires deflate.
2. If shipment is made on open freight cars the device prevents pilferage of tires en route, which every motor car manufacturer knows has been a very serious matter.
3. It substitutes 4 for 24 parts. The wood outfit comprises 8 blocks, 4 tie-downs, 4 side strips, and 8 heel blocks. The other consists simply of 4 one-piece devices, fastened by means of double-headed nails to the floor of the car.

The chief disadvantage of this device is the cost. At an initial cost of $6 a set of four pieces, to use once and then scrap is obviously out of the question. The only alternative is to have the equipment returned after use, but there, too, the cost is practically prohibitory. The hold-downs weigh from 40 to 50 lb. per set. Average return freight, figured at $1.25 per hundredweight, would amount to from 50 to 62½ cents per set, to say nothing of the added cost of packing, cartage, billing, accounting, etc. Against this, place the fact that the wooden block sets cost complete but from 64 cents to $1.12, and it is easy to see why the Flint device has not made greater progress than it has.

One manufacturer tested 20 sets of the Flint device over a period of seven months, during which 117 shipments were made. No automobile was damaged and there were no chafed tires. But the manufacturer reported considerable difficulty in getting the equipment back promptly. He had to write several times to many of the dealers. Some insisted on returning the devices by express. The average round-trip of a set of hold-downs was 8 to 9 weeks under ordinary conditions. It is evident, then, that wood-block loading is likely to hold its own for some time to come.

FIG. 8 THE "FLINT DEVICE" INVENTED BY JOSEPH DE FRAIN

A clever "first aid to loading," illustrated in connection with this article (See Fig. 9), is a loading frame on casters for double decking automobiles. The motor car is run onto the frame in such a way as to bring the axles directly over the four jacks. The jacks are then raised to bring the automobile to the proper height for decking, and the frame is rolled onto the freight car. By the use of such a frame, this part of the loading is speeded up fully 50 per cent.

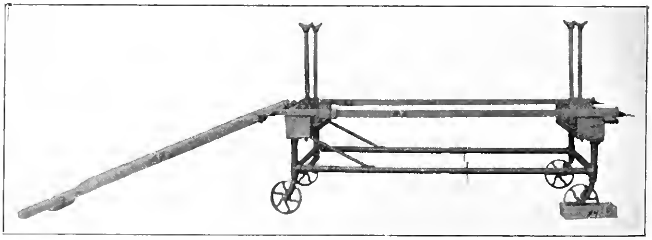


FIG. 9 LOADING FRAME USED IN "DOUBLE-DECKING" AUTOMOBILES FOR SHIPMENT

Control Through Organization and Budgets

Responsibilities and Relations of the Four Operating Divisions—Manufacturing, Finance, Engineering, Sales

By THOMAS B. FORDHAM and EDWARD H. TINGLEY

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Index Number
658.16 Organization
657.524:658 Cost control

No business enterprise can succeed unless it makes a profit. But profitable operation depends to a great degree upon a well-balanced organization with duties clearly and correctly defined. The authors describe what they have found by experience to be the necessary elements of organization, and the grouping which seems best suited to insure the greatest success. The plan outlined is one that fits in with the application of a comprehensive departmental budget system.

TWO of the most important fundamentals of a successful enterprise are: (1) the personnel and its organization; and (2) control of finances, operation, and sales by means of a budget. The present article deals primarily with the first of these fundamentals.

Business is operated only to make a profit. This sentence should be posted in every office and factory and be constantly in mind as every executive makes his decisions. Half of the manufacturing industries in the country today are not making a profit, and it is evident that they are badly in need of a measuring stick against which to judge the value of their methods. Every policy established, every piece of equipment purchased, every rearrangement of the machinery, every detail of the production system, every financial transaction must be carefully weighed and performed only if it will yield a profit. Even such an altruistic part of the business as the first aid or medical department should be continued only if it can show a profit. It may not be an immediate tangible profit in dollars to render first aid to an injured employee and return him to his machine within half an hour, but were he allowed to go home, his idle machine would cost far more to production than the few minutes of the nurse's time spent in taking care of him.

The statement in the previous paragraph, that "business is operated only to make a profit" must be taken in conjunction with the service that the product renders. It is absolutely true that many industries perform an inestimable public service through their product and the quality maintained, nevertheless the business would not continue to exist unless a profit was realized. The selection of a product that fills a real human need is only a wise precaution which insures that there will be sufficient sales demand to pay a profit. A solid and lasting foundation for sales can be built only on a product which offers genuine service.

There must be four main parts to every industrial enterprise and there need not be more. These are grouped as follows:

1. The engineering division; that part which invents and designs the product to be manufactured.
2. The finance division; that part which provides the capital and handles the financial operation of the business.
3. The manufacturing division; that part which manufactures the product.
4. The sales division; that part which sells the product.

As the reader analyzes his business, it may seem that there are more than four divisions, but a study of all the conditions and facts will reveal that the above classification is ample enough. The individual business governs the importance of each of these divisions, but the four will be found to exist in some form or another in every industry. Investigations in many factories have disclosed the fact that a division has been split into two or more parts, with different executives placed in control of each, and each part classed as a major division. Rarely has such a state of affairs operated satisfactorily, economically, or without constant argument, jealousies, and working at cross purposes. Duplication of work will occur and authority will overlap. It should not be necessary for the chief executive to consult a dozen men to control the work but just four mentioned above.

A strong organization has the following main features:

1. Proper selection and training of assistants and subordinates.
2. Good and sufficient pay for the posts to be filled.
3. No overorganization, i. e., not too many people with too little authority.
4. No underorganization, i. e., not too few people to do the work involved.
5. Confidence in those under him, on the part of the executive in charge.
6. Good morale—proper company spirit and satisfied employees.

7. A correct and thorough understanding of individual responsibilities, the limits of the work to be done, and the results to be secured.

The last item is the most important one and ofteu forms the main difficulty in making an organization successful. Responsibilities must be definitely laid down and the individual held strictly accountable.

The Four Main Divisions

The *engineering division* is the gradual development and the eventual outgrowth of the inventive and experimental work done in perfecting the product. The expansion from the original idea to the development of working models, thence to the necessary designing and drafting for the requirements of the manufacturing division, all result in an organization like Fig. 1.

The management is confronted by many financial problems, and the *finance division* must of necessity be originated to solve them. Its work inclndes the handling of all cash, operations in commercial paper, loans, credits and collections, and the accounting records necessary to cover the financial operation of the business.

The executive in charge of this division should be an expert in matters of finance and business. He must have a clear comprehension of the operating costs and rates of profit desired for the business. He should have such a control of the business from a financial standpoint, that he can quickly point out the danger spots as indicated by losses, and forestall them by having the executives in charge change methods or conditions.

The finance division splits into two sections, one devoted to the actual financing of the enterprise and the other to accounting, as shown in Fig. 2.

The *sales division* is usually the first to be fully organized in any business. In this division there are three main sections, as charted in Fig. 3. The development of these sections depends upon the needs of the product but sooner or later the three will appear in every line of industrial endeavor.

The organization of any *manufacturing division* needs five sections, no more and no less. These five are:

- Plant section, in charge of buildings and grounds.
- Equipment section, in charge of planning, and machinery, tools and equipment.
- Materials section, in charge of procurement and handling of materials.
- Labor section, in charge of selection, placement, and welfare of labor.
- Productive section, in charge of manufacturing the product.

As an organization chart these sections appear as shown in Fig. 4.

Plant Section. Every industry must have grounds and buildings in which to operate. These must be kept in repair and condition suitable for the making of the product. The capital invested in them must be protected from loss by fire, theft, or other causes. It is the responsibility of the head of this section to see that these results are secured.

Equipment Section. An industry must have machinery, tools, and equipment of some sort for the manufacturing of the product. These must be maintained in a condition suitable for the turning out of the product. The capital invested must also be protected from undue loss through too rapid deterioration.

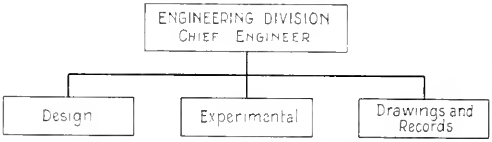

FIG. 1 ORGANIZATION OF ENGINEERING DIVISION

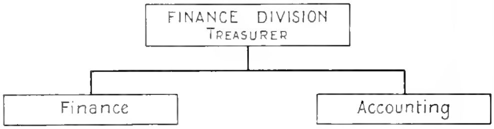

FIG. 2 ORGANIZATION OF FINANCE DIVISION

The production operations (including the location of all machinery, tools, and equipment) must be planned and arranged to conform to the requirements of the product, and in such a manner as to secure the most economical and profitable results with the buildings, grounds, and finances at hand for the purpose. The head of this section should be responsible for these matters.

Materials Section. Materials to make the product are necessary in every manufacturing industry. The responsibility of the head of this section is to secure the raw materials through purchases; to control their progress through the factory as they are being transformed into finished products; and to store the output in suitable shape and ship the completed product. All materials needed indirectly for the operation of the factory departments are also the property of this section.

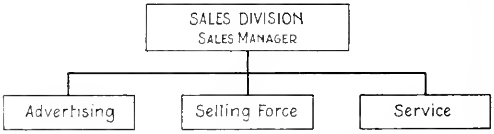

FIG. 3 SALES DIVISION ORGANIZATION

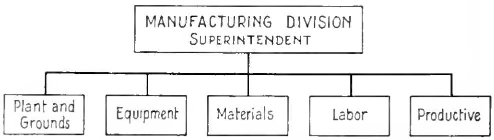

FIG. 4 MANUFACTURING DIVISION ORGANIZATION

Labor Section. Labor is required to work on the material for the completion of the product. The responsibility of the head of this section is to secure the right kinds of labor through employment facilities, and arrange their compensations to agree with the standard of living in the locality of the plant, and to attend to all matters of a welfare nature which may be required to hold down labor turnover.

Productive Section. The head of this section must utilize the facilities of plant, equipment, materials, and labor, placed at his disposal for productive purposes by the other sections referred to above, and turn out the finished product therewith at the lowest cost possible.

Having outlined the organization of the personnel in an industrial plant in general terms, we shall next turn our attention to an explanation of the details of one of the divisions—the manufacturing department. The work divides into five sections as classified above. These will be taken up in the order named.

The Plant Section

The specific responsibility of the plant section is to maintain the buildings and grounds in a condition suitable for occupation by the employees and for the manufacturing operations which are to take place within them. Buildings and grounds constitute a considerable share of the total investment of any business and the head of the plant section has a very heavy responsibility in their maintenance and protection. His duties are divided into four divisions, as in Fig. 5.

1. *Construction and Maintenance.* In the ordinary factory this is the major portion of the work of the plant section, for with the modern tendency to adopt new methods and improvements in processes and plant layout, the four departments—carpentry, plumbing, electrical, and millwright—are usually kept busy.

The following paragraphs describe briefly the responsibilities of each of the four departments that comprise the construction and maintenance group:

(a) *Carpentering.* The head of the carpenter department is responsible for the construction of all new woodwork and the protection and upkeep of all installed woodwork in the plant. Under this heading would come all doors, floors, partitions, shelving, roofs, platforms, repair of desks and chairs, etc. The carpenter foreman should also be in charge of all painting of both wood and metal parts of the factory buildings.

(b) *Plumbing.* To this department is delegated the responsibility for the repair and upkeep of all present plumbing throughout the plant and the installation of new equipment as necessary. Under plumbing are classed all pipe lines for compressed air, gas, steam, fuel oil, fire sprinkler systems, drinking water, and sanitary facilities of the plant.

(c) *Electrical.* This department maintains all the electrical equipment used in the factory in condition to perform the required functions. Within the scope of this department would come any new construction work that involved electrical equipment of any nature, all wiring and transformers used for light and power, the care of all electric heating units, renewing of bulbs in the lighting fixtures, the repair and installation of motors which drive the line shafts and the individual motors on the machine tools, upkeep and installation of telephones, and the charging of the storage batteries for the electric trucks of the factory transportation system. The care of the electric generators belongs to the foreman in charge of the power-house.

(d) *Millwrighting and General Labor.* To this department is assigned all the general labor work of the plant, such as maintaining and grading the grounds, the inspection and care of the foundations and floor supports of the buildings, all concrete work, erection of machinery and line shafting, and moving of equipment of any kind. This group assumes all the other maintenance work not specifically falling under the three departments mentioned above.

2. *Sanitation and Cleanliness.* The work of maintaining the buildings and grounds in a clean and sanitary condition, fit for the employees to work in, has become of increasing importance, due to the close relationship between sanitation and public health, and to the increasing personal pride of the employee himself.

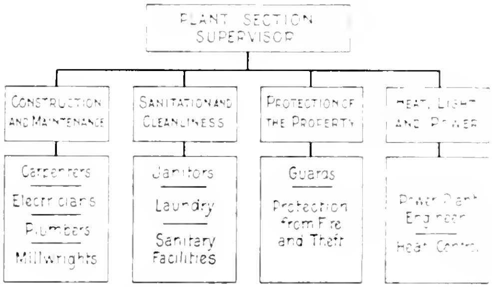

FIG. 5 ORGANIZATION OF PLANT SECTION

The janitor foreman supervises the cleaning of toilet facilities, main aisles, elevators, and roadways. The cleanliness of each productive department is in charge of its foreman. The removal of scrap and waste product comes under the responsibilities of the supervisor of materials.

3. *Protection of the Property.* This department is composed of guards who have the duty of maintaining a constant inspection day and night of all building and property as a protection against fire, damage from defective equipment, and theft. A special feature of their work is the inspection and maintenance of the fire fighting apparatus in a condition for immediate use, and the organization of fire brigades. It is their responsibility to permit no loss, through preventable causes, of the money invested in the plant. The aim of this department is also to aid in lowering insurance rates.

4. *Heat, Light, and Power.* These three elements are a very vital part of every manufacturing industry and vary in their importance according to the type of product made in the industry.

In many industries a complete power-plant is a part of the plant equipment and coal is burned under boilers to generate steam, part of which is used for power in steam-engines which drive electric generators, and part for the heating of the buildings and the processes of manufacture. The foreman of the power-plant is usually responsible for the successful operation of both boilers and engines and also for the electric generators and supply of current for power and light. A good, careful man in this position can save considerable money by watching the use of steam for heating and still keep the factory sufficiently warm for productive purposes.

In small factories where electric power is purchased and not generated, the foreman of the electricians can be held responsible for the use of the electrical current. If steam is also purchased, the plumbing foreman could no doubt add to his responsibilities that of keeping the factory warm in winter.

The supervisor of equipment has two main functions to execute:

1. Planning the use of equipment and tools, including the layout of department, routing of materials, and setting of standard times for operation.
2. Procurement and maintenance of tools and equipment through purchasing, designing, manufacturing, repairing, and storing.

The chart of organization for this section is shown in Fig. 6. Each of these departments will be discussed separately to show in detail the problems which they solve and the scope of their work.

Equipment Department—Planning Group

1. *Estimated Cost Department.* As its name implies, this department is responsible for the compilation of the estimated costs of the various products manufactured, in contrast to the actual costs gathered by the cost department. The aims of this department can best be expressed in the following sentences:

(*a*) To understand thoroughly the internal manufacturing processes so as to be able to compile complete costs of every part and assembly of the product by the proper segregation of the data available.

(*b*) To understand what makes up the factory cost of the product and to know how properly to allocate labor, material, and burden to the various piece parts and assemblies.

(*c*) To follow the material markets so closely that estimates of material costs can be made without resorting to quotations from any source of supply.

(*d*) To understand the efficiency of the various producing departments, knowing what are normal conditions of operation and what the possibilities are for increased efficiency.

(*e*) To be able to estimate a factory cost on the piece parts and entire cost of the product, which will be a "bogey" figure that should be followed and attained in the manufacture of the product.

(*f*) To be able to compare the actual costs and the estimated costs and point out the reasons why the productive section is not working as efficiently as planned.

(*g*) To be able to estimate the cost of producing new products and assist the general manager to set a selling price that will net sufficient profit.

(*h*) To be able to estimate the cost of making changes as requested by the engineering division in the materials, operations, etc., of the product so that the management can decide the advisability of making the desired changes.

(*i*) To provide tabulated data of hours, costs, materials, departmental burden, etc., of the parts and complete assemblies of the product which the betterment department can use in its efforts to reduce costs.

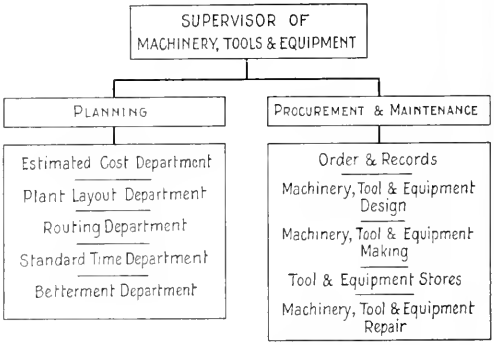

FIG. 6 EQUIPMENT SECTION ORGANIZATION

2. *Plant Layout Department.* The executive in charge of this department should be responsible for the correct placing of the equipment so that the space available in the buildings or on the grounds is most advantageously used and that the progress of the material which composes the product follows the shortest path through the factory both in time and actual distance.

The design and the supervision of the installation of all new departmental equipment is another function of the plant layout department. This type of equipment may include all conveyor systems for handling materials, ventilating fans and piping, special testing equipment, dust collecting and removal apparatus and similar devices. To these items should be added the design of the special platform trucks, stock boxes and similar containers in which the material is transported through the factory, from one operation to another in the process of manufacture.

3. *Routing Department.* This department details and maintains the records of the proper sequence of all manufacturing operations on every item of the product. Such procedure must be carefully followed

in order to insure securing the greatest degree of efficiency through the following of repetitive operations by the productive section.

4. *Standard Time Department.* The standard time department as discussed in this article is not based on any one definite system, but covers any modern method of securing increased production from the employee through the incentive of increased pay. Whatever the plan may be that the individual business has adopted, it should be handled by an expert as the head of this department.

5. *Betterment Department.* The betterment department should have as its objective the following functions:

(*a*) Reduction of the cost of individual pieces through a study of processes, operations, and results.

(*b*) Reduction of the cost of complete units of the product by a study of assembly operations, plant layout, and relations of the assembly departments to the finished stores, and by a study of packing and shipping facilities.

(*c*) Reduction of the burden expenses accruing in each department by a study of the causes and effect of such expense.

(*d*) Improvements in design with the aim of reducing the costs.

(*e*) Experimentation with new ideas to ascertain if they will reduce the cost or better the operation of the product.

(*f*) A study of materials and their costs and analyses made to determine the advisability of using a substitute.

(*g*) The relation of the labor used to the quality of the product.

(*h*) Increase in efficiency of the entire factory by securing better co-operation between all the units in plant and office.

Equipment Department—Procurement and Maintenance Group

When the work of the planning group has been laid out it is turned over to the procurement and maintenance group for execution. By referring to the organization chart, Fig. 6, it will be seen that the sections are arranged in logical order.

1. *Orders and Records.* The man in charge of this department has supervision over the making out of orders for tools and fixtures as required by the planning section, purchase orders for tools and equipment bought outside, orders for patterns, etc. In addition, he has charge over records of progress of work on orders for tools, of records of machinery and equipment throughout the plant, and similar information which is within the province of his department.

2. *Machinery, Tools, and Equipment Specification and Design.* In the design of tools the supervisor of equipment is directly responsible for the details of the tools and the adequacy of the design. He must always have in mind the two main purposes in the use of tools and fixtures: (1) to produce in large quantities parts which are duplicates and interchangeable; and (2) to increase the speed of production.

3. *Machinery, Tools, and Equipment Manufacture and Procurement.* If it is necessary that the equipment supervisor have direct control over equipment design, it naturally follows that he should have the supervision over the department in which the tools, machines and devices are to be manufactured. Whether this work is to be done in a separate toolroom or in the general productive departments, the direction of the work and its expense must be controlled by him.

4. *Tool and Equipment Stores.* As soon as any tool or item of equipment is received, it should be turned over to the equipment supervisor as his property. He is responsible for its storage in suitable stockrooms, or, in the case of machinery, its location in the proper departments, and for the issuance of such tools as are needed by any of the departments of the factory. He must protect the investment in machinery and equipment from too rapid deterioration and have full authority to prescribe the speeds and feeds of any machine to prevent overloading and consequent damage. This continuous responsibility naturally leads into the next subject of repairs.

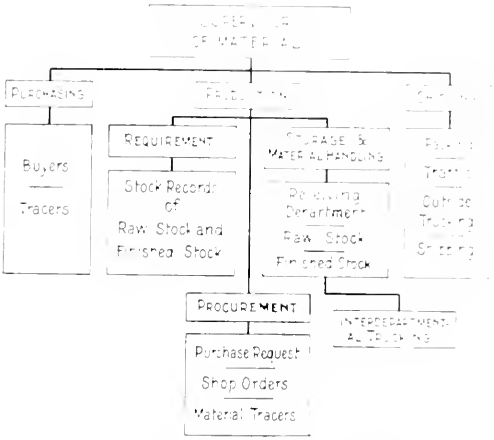

FIG. 7 ORGANIZATION OF MATERIAL SECTION

5. *Machinery, Tools, and Equipment Repairs.* In most industries the repair department is a well-recognized unit and functions continuously to maintain the equipment in the proper condition to perform the production operations. The repair of special tools and fixtures is a definite part of the work of the toolroom or a tool repair department and properly comes under the equipment supervisor's authority.

Materials Section

The responsibility of the materials section can be grouped under four heads:

1. *Material requirements,* consisting of the determination of the quantities of materials necessary, issuing of the purchase requests, and the control of the flow of materials through the factory.
2. *Material procurement,* through the purchasing of the necessary raw materials and the finished purchased parts.

3. *Material handling*, consisting of the receiving of the purchased and raw materials, the transportation of all materials as they flow through the factory, and the storage of the finished parts and the completed product.
4. *Shipment of material*, consisting of the determination of the traffic requirements, and shipping of the product to the customer.

All of these fundamentals are shown in the organization chart, Fig. 7, although the functions are grouped under three persons who are charged with the duties under purchasing, production, and shipping.

Labor Section

On the organization chart for the manufacturing division, Fig. 4, all labor and its related phases are shown grouped under the labor section. This places under the control of one person all the agencies for procuring labor, for its compensation, and for the maintenance of its welfare and good-will.

The responsibilities of the labor section cover three lines of endeavor:

1. The selection and employment of the right kind and caliber of labor needed for the various kinds of work being performed in the factory.
2. The computation of the wages to be paid the employee for the services rendered.
3. The maintenance of the physical welfare of the employees and the study of the mental reactions of labor to local conditions.

These three divisions may be called—employment, compensation, and welfare. Under each of these divisions there may be several departments necessary to take care of the various duties involved. As an organization chart they are illustrated in Fig. 8.

Productive Section

The economical and proper use of the plant equipment, material and labor, in the evolution of the product, must be the responsibility of the supervisor of the productive section. To other sections has been delegated the furnishing and care of these four fundamentals, but to this section is given the task of using all of them in transforming the raw material into the finished product which can be sold at a profit. Stress should be laid upon the ability to secure a profit upon the product, for without a profit there will soon cease to be production. Therefore it is a prime requisite that the productive section perform its duties in the most efficient manner so that the required profit will be forthcoming.

Considered from the standpoint of the individual who is placed in charge of the productive section, production work requires both a specialist and a broad-gage man. On the one side he must know the product and how to manufacture it in the quantity and quality desired, and on the other, he must know how to handle men and secure the necessary co-operation which results in the efficient operation of his organization. He must also be a business man realizing that in his hands rests a large share of the responsibility for making profits for the company. Costs depend on how well he utilizes buildings, equipment, materials and labor.

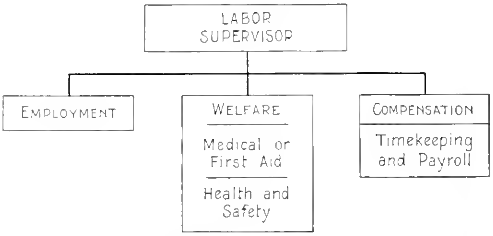

FIG. 8 LABOR SECTION ORGANIZATION

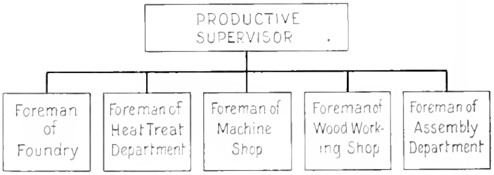

FIG. 9 PRODUCTIVE SECTION ORGANIZATION

In his work he must, therefore, insist on the following:

1. Satisfactory buildings and grounds—properly kept in condition for the manufacturing operations.
2. Modern machinery, tools, and equipment which will efficiently produce the product in the quality and quantity desired. These items must always be kept in working condition.
3. Suitable supplies of materials of the right quality furnished within a time that will permit the product to be manufactured according to schedule.
4. Sufficient supply of the right caliber and class of labor which can be readily assimilated into the organization.
5. The right kind of foremen who can inspire confidence in their men and secure their co-operation and loyalty.
6. A good system of production that will co-ordinate the work of the various producing departments and assist in meeting the required dates of completion of the product.
7. Co-operation of the management and the other sections of the manufacturing division so that a general scheme of production is followed and a unity of purpose maintained.

The organization chart of the productive section should be as shown in Fig. 9, assuming names of various production departments as illustrations.

It may seem that the above discussion can be applied only to large and highly organized plants. Such is not the case. By proper condensation and grouping it becomes adaptable to the small plant as well.

Later articles will take up the control of plant operation by means of a practical budget system.

Checking Up the Forecast

"How the Walworth Company Looks Ahead"—Article Six

By JOSEPH H. BARBER

[illegible]

PHILOSOPHERS and theorists! What have they to do with business? And yet in this connection our president has just said:

> Year by year business is becoming more and more a profession through the study of commercial and industrial problems.
>
> A decade ago if a man had dared to submit accurate estimates of the future volume of business of any company, no matter how large or small, he would have been put down as demented, and even today many people would call him mildly insane.
>
> Before the war the usual description of a capable executive was "He has remarkable ability in meeting the situation"—the assumption being that such a man was bound to have to a large extent quick brain action, courage, and good common sense. It will not be long before this definition will be obsolete. Already other characteristics are required of the successful manager. Among the first of these comes intelligent foresight. An executive's qualification is today measured by his ability to anticipate rather than to meet a situation.

Now, "anticipating a situation" suggests forecasting; forecasting implies "theories"; and the title "theorist," so commonly thought to mean "one who indulges in theories," is distasteful to every business man.

But, after all, a theory may be a "plan or scheme theoretically constructed," that is, "framed to agree with observed facts." In this sense, many a practical business man who will deny that he is a theorist, does nevertheless, intuitively or consciously, use his experience—his observation of facts—when making decisions affecting the future. The degree of value in such decisions depends upon how accurate the observation has been, how well the information has been classified and recorded by the memory, and the adequacy with which the "similar case back in 1917," now recalled to mind, aids in the current decision.

It follows that the "practical" business man, in this mental process, relies upon his own experience only, the experience he has acquired over long, and many, hard years. Contrariwise the decisions he makes are valuable only as they are determined by the facts of his own observation. When the problem lies outside his field of experience, he may "decide," yet fail truly to anticipate the future, because the steps followed in "theorizing," which he follows intuitively as a business man, do not find adequate material in his own experience.

At this point the "practical" man calls on the "theorist," who gathers the necessary facts, observes their implications, and deduces their meaning as to the future. Sometimes the "theorist" is right. More often, he lacks the practical experience necessary to discriminate in values; overlooks consideration of certain conditions which do not happen to submit readily to measurement or evaluation; fails to include some very significant factor; or forgets that a business man's ear is necessarily trained to listen for the sound of dollar profits. "Plans or schemes theoretically constructed," to be worth while, must hold water; must mean profits.

Index Number
657.524:658 Cost control
658.53 Production records and analysis

To meet this requirement the practical theorist has been evolved. One who first visualizes his theories in written or graphic form, then submits them to stern tests in practice; checks them himself from many angles; proves the profit to be derived; and, finally, personally shows how it all applies to the current day's needs.

These are severe requirements. But beyond this is the prime requisite that action must be immediate, else the plan may become stale. It must, therefore, be promptly available for use, complete, standing on its own legs ready for the immediate test of events.

In such a setting, then, do we find the function of the "planning department," the "business research department," or call it what you will. It may have available all the experience records of the enterprise; it may gather facts and study barometers; it may analyze and chart; but it must yield continuously "plans and schemes theoretically constructed," which shall nevertheless find acceptance for guiding the enterprise in profitable progress.

Theory Tested by Performance

Even the current accounting records then take on a new significance. Actual facts, currently accumulating, assume a friendly, familiar form, not greatly different from that suggested by the previously constructed theory. For current performance is a working out of that theory, and the theory is tested by the current performance.

The viewpoint calls for a change in the usual form of each current accounting report. There has been a plan or scheme. Therefore, the current report must include a comparison of performance against that plan or scheme as embodied in the approved estimate.

Moreover, the plan or scheme was developed in the light of business cycle theory. Therefore, the current month's report of actual performance will not emphasize so greatly performance comparisons with many recent months as it will emphasize current performance in relation to business cycle changes. To this end, and yet to conserve the executive's time, the current report must yield such a picture in such a way that the exceptional cases may immediately become the focal points of executive attention.

Checking Up Sales

Table 13 shows the form of our monthly sales report.[1] Performance is first compared with estimate. However, since monthly performances are sometimes erratic, the report yields also year-to-date comparisons. Impression as to the current trend is gained by comparison with "Last Month" and the location within the cycle is gained through year-to-date comparison with a "Year Ago." In all comparisons the eye quickly locates exceptional cases through casual observance of the "Per Cent Increase or Decrease" columns, the key to the exceptional case being the greatest percentage of deviation.

Fig. 13 shows a little more definitely how the "Year Ago" comparison yields an impression of location within the business cycle. The chart simply plots against a zero line in historical sequence, the percentages of each current month's sales over the sales of the same month just a year ago. This zero line is simply a convenient plotting line for making graphic the historical series of percentages; it does not represent any normal. The percentages do give a cycle index of sales, essentially eliminating the confusing seasonal variations present in the dollar, or ton, sales figures; and the graphic plotting shows, moreover, that the cycle swings of the index precede by some months the cycle swings of actual sales.

The cycle trend, however, in this curve is unmistakable. Recovery from a depression first decreases the percentage *under* a year ago, while sales are yet low. Continued recovery creates percentages *over* a year ago, reaching highest percentage levels *before* the peak of prosperity. On the other hand, at the peak of prosperity, while monthly actual sales are still at high levels, this Fig. 13 curve will have been consistently declining for many months.

The decline of this monthly index, or the similarly decreasing percentages (on the year-to-date basis) appearing on the successive issues of the Table 13 report, serves notice that sales are already meeting the resistance that eventually means decline in actual sales. We may anticipate that the Fig. 13 curve will continue cyclical decline until it passes the zero line (indicating an actual decline in dollar sales, as well) because business does not become static at any given level. Business is buying and selling. Increased buying is not so much against increased needs as against a fear of increasing prices. At the peak of sales this initial fear is replaced by another fear—that prices may fall. Curtailment of buying, due to this latter fear, is gradual. It is to be noted, however, that this fear of

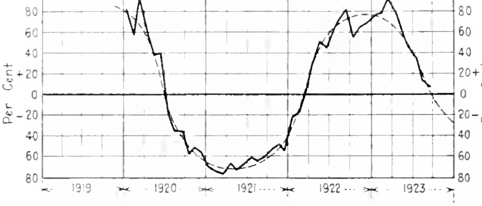

FIG. 13 INDEX OF ACTUAL CURRENT SALES TO CUSTOMERS

falling prices, this sales resistance, reflects itself in the Fig. 13 type of curve, and in the year-to-date "year ago" percentage columns, many months before ordinary forms of "historical" sales reports, in dollar, or quantity values alone, would reflect the approach of a decline.

Varying Forms of Reports

The Table 13 type report is applicable, as is, to so many phases of current reporting that further exhibits are not given to show such application. However, there is a slight variation which has proved valuable for the monthly report of pay-rolls, shown on page 727 in the form of Table 14.

In this case year-to-date figures have no significance, nor are they necessary to eliminate erratic tendencies, as these do not occur in pay-rolls. In place of year-to-date columns, we provide a column giving the details of July 1921, pay-rolls. Such a remote month is selected because the figures for that month represent our rock bottom of pay-roll during a depression, and because, presumably, and if necessary, we could curtail to that extent again. Here, again, the percentage column is most valuable. With permanently declining sales and the consequent curtailment of production, the percentage increase of pay-roll over July 1921, should constantly decline in proportion to the severity of the curtailment program.

[1] Acknowledgment must be made to J. O. McKinsey, author of "Budgetary Control," for some executive report form suggestions, accepted in 1920 and still retained in this style of tabulated report form.

TABLE 13. MONTHLY REPORT OF SALES

(Net Billing to Customers Only)

Month of September, 1923

Sales Unit	This Month	Estimated This Month	Per Cent Inc. or Dec.	Last Month (Audit.)	Per Cent Inc. or Dec	To Date This Year	Estimated to Date This Year	Per Cent Inc. or Dec.	To Date Last Year	Per Cent Inc. or Dec.
Eastern division	000,000	000,000	*0*	000,000	*0*	0,000,000	0,000,000	0	000,000	00
Western division	000,000	000,000	*0*	000,000	*00*	0,000,000	0,000,000	0	0,000,000	00
Total divisions	000,000	000,000	*0*	000,000	*00*	0,000,000	0,000,000	0	0,000,000	00
Boston branch	000,000	000,000	*0*	000,000	00	0,000,000	0,000,000	0	000,000	00
New York	000,000	000,000	*0*	000,000	0	0,000,000	0,000,000	0	000,000	00
Chicago	000,000	000,000	*0*	000,000	*0*	0,000,000	0,000,000	0	000,000	00
Seattle	000,000	000,000	*0*	000,000	*0*	0,000,000	000,000	0	000,000	00
Philadelphia	000,000	000,000	0	000,000	*0*	0,000,000	000,000	0	000,000	00
Portland	000,000	000,000	*0*	000,000	*00*	0,000,000	000,000	0	000,000	00
Total branches	000,000	000,000	*0*	000,000	*0*	0,000,000	0,000,000	0	0,000,000	00
Walworth International Co	000,000	000,000	0	000,000	0	0,000,000	0,000,000	0	000,000	00
Walworth-Ohio Co	000,000	000,000	*0*	000,000	*0*	0,000,000	0,000,000	*0*	000,000	00
Walworth-Munzing Co.	00,000	00,000	0	00,000	0	00,000	00,000	0	00,000	00
Total	0,000,000	0,000,000	*0*	0,000,000	*0*	00,000,000	00,000,000	0	0,000,000	00

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In certain monthly reports, where the figures indicate exceptions, and where these exceptional figures mean little unless the explanation is at hand, the "past" columns give way to a column providing for comments against exceptional items. Table 15 shows this type of report, as a part of which unusual deviations from estimate are in each case accompanied by specific explanations.

[illegible]	$000,000	[illegible]					
[illegible]	000,000	[illegible]					
[illegible]	000,000	[illegible]					
[illegible]	00,000	00,000					
[illegible]	00,000	0,000					
W[illegible]	000,000	000,000					
T[illegible]	000,000	000,000					
A[illegible]							
[illegible]	00,000	00,000					
Ma[illegible]	0,000	0,000					
Wages	000,000	000,000					
T[illegible]	000,000	000,000		[illegible]		[illegible]	
Eastern division [illegible]	0,000	0,000		[illegible]			
Western division [illegible]	00,000	00,000		[illegible]			
Total	00,000	00,000		[illegible]			
Total branches (-50, -52, -56	00,000	00,000		[illegible]			
Total branches (-55	00,000	00,000	0	[illegible]			00
Total branches (salaries and wages)	00,000	00,000	0	00,000		[illegible]	00
Boston branch (-50, -52, -56	0,000	0,000	0	0,000		[illegible]	00
Boston branch (-55	0,000	0,000		0,000		[illegible]	00
Boston branch (total	00,000	00,000		00,000		[illegible]	00
New York (-50, -52, -56	0,000	0,000		0,000	0	[illegible]	00
New York (-55	0,000	0,000	0	0,000	0	[illegible]	00
New York (total)	00,000	00,000	0	00,000	0	000	00
Chicago (-50, -52, -56	0,000	0,000	0	0,000	0	000	00
Chicago (-55	0,000	0,000	0	0,000		0,000	00
Chicago (total	00,000	00,000	0	00,000	0	0,000	00
Seattle (-50, -52, -56	0,000	0,000	0	0,000		0,000	00
Seattle (-55	0,000	0,000	0	0,000	0	0,000	00
Seattle (total)	0,000	0,000	0	0,000	0	0,000	00
Philadelphia (-50, -52, -56	0,000	0,000	0	0,000		0,000	0
Philadelphia (-55	0,000	0,000	0	0,000		0,000	0
Philadelphia (total	0,000	0,000	0	0,000		0,000	0
Portland (-50, -52, -56	0,000	0,000	0	0,000		0,000	00
Portland (-55)	0,000	0,000	0	0,000		0,000	00
Portland (total)	0,000	0,000	0	0,000		0,000	00
Walworth Int. Co. (-50, -52, -56)	0,000	0,000	0	0,000		0,000	0
Walworth Int. Co. (-55	0,000	0,000	0	0,000	0	000	00
Walworth Int. Co. (total	0,000	0,000	0	0,000		0,000	0
Walworth-Ohio Co. (-50, -52, -56	0,000	0,000	0	0,000	0	0,000	00
Walworth-Ohio Co. (-55	0,000	0,000	0	0,000	0	0,000	00
Walworth-Ohio Co. (tota	0,000	0,000	0	0,000	0	0,000	00
Walworth-Munzing (-50, -52, -56)	0,000	0,000	0	0,000	0	0,000	0
Walworth-Munzing (-55	0,000	0,000	0	0,000	0	000	00
Walworth-Munzing (total	0,000	0,000	0	0,000	0	0,000	0
General office (salaries	00,000	00,000	0	00,000	0	00,000	00

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Boston, October 9, 1923

Nature of the Monthly Reports

All these monthly reports are, of course, only the monthly interpretive reports summarizing the customary daily, or detail monthly reports, which cover every phase of the business—production tonnage, shipments analysis, credit conditions, and the like. Such interpretive analysis is given each group activity of the business no less frequently than every month. Budget estimates have given the initial pictures of developing situations. These monthly checking-up reports confirm the general accuracy of the original picture; and the daily and weekly reports supplement in the intervening period.

The monthly report, then, is the focal point of all the company's statistics. Here past meets the future, and if harmony does not result an explanation must be forthcoming. While the figures are yet fresh, even before they are fully audited, the planning section, with all facts available, prepares the summaries, their interpretations, and their explanations. Even though the reports do not constitute final accuracy, they are essentially correct for guidance and they lead to executive action while there is yet time to effect changes where they may be necessary.

Inventory and Production Rate Analysis

To show graphically how these monthly reports apply, the philosophy that the present is the connecting link between the past and the future, additional exhibits will indicate how a definite "check-up" of the present performance as against a previously planned performance aids in quickly, but nevertheless definitely, locating "where we are" and "whither we are going." Charts of this nature are shown in Figs. 14, 15, and 16.

Fig. 14 illustrates the form of a series of charts covering past, present, and estimated future inventories, production rates, and the factors affecting them. A separate chart for each of our product classes is posted monthly to show the latest projection of the past into the future, which has been previously estimated. The chart is prepared as of September 20, 1923, assuming September totals on the basis of month-to-date indications, and estimating all other future rates or levels.

The appearance of the chart suggests a complexity that vanishes upon closer acquaintance. Its design makes use of several advantages of the ratio chart as an aid to the executive, who can gain the necessary impression as to the trend of each product class in a very brief space of time. His closest attention need be given only to the easily recognized exceptional cases requiring analysis, and resort to figures in tabulated reports close at hand, will confirm the impression of need for further investigation at that point.

In explanation of this chart it may be said that production is for finished inventory. Finished inventory is maintained for the prompt shipment of orders as received. Therefore inventory efficiency is measured in terms of orders. On the other hand, the production rate, ideally, would put into a minimum

TABLE 15 MONTHLY REPORT ON CASH DISBURSEMENTS *Month of September, 1923*

PURPOSE	AMOUNT DISBURSED	ESTIMATED DISBURSEMENTS	PER CENT INCREASE OR DECREASE	COMMENTS
G. O.				
[illegible]				
General office	$00,000	$00,000	0	
E. D. and Boston works	000,000	000,000	0	
Boston branch	00,000	00,000	0	
Other branch managerial	0,000	0,000	0	
Pipe				
E. D. and Boston works	0,000	0,000	00	
Branch stock (inclu. Walw. Int. Co.	000,000	000,000	00	
Branch direct shipments (inclu. Walw. Int. Co.	00,000	00,000	00	Includes $00,000 N. Y. N. H. & H. R. R. Co 00,000 Carnegie Steel Co
Resale				
E. D. and Boston works purchases (ex. pipe	000,000	000,000	00 .	
Boston branch purchases (ex. pipe	00,000	00,000	0	
General office purchases	00,000	00,000	0	
Total general office (except Inter-Co.)	000,000	000,000	0	
General office to W. D.	00,000	00,000	0	
Total G. O. disbursements	000,000	000,000	0	
W. D. and Kewanee Works				
W. D. and K. W. pay-rolls (Wage roll includes 4 weeks disbursements	000,000	000,000	0	
Resale material (inclu. steel and iron pipe)	0,000	0,000	00	
W. D. and K. W. purchases	000,000	000,000	0	
	000,000	000,000	0	Includes $00,000 American Radiator Co 0,000 John Simmons Co. 0,000 Swartout Co.
Branches (does not include Pipe)				
New York purchases and pay-roll	00,000	00,000	00...	
Chicago purchases and pay-roll	00,000	00,000	00	
Seattle purchases and pay-roll	00,000	00,000	00....	Includes $00,000 American Radiator Co. 0,000 Standard Sanitary Mfg. Co. 0,000 Birchfield Boiler Co. 0,000 U. S. Radiator Corp. 0,000 Glauber Brass Mfg. Co. 0,000 West. Coast Porcelain Co. 0,000 Godfrey, Jones Co.
Philadelphia purchases and pay-roll	00,000	00,000	0	Includes $0,000 Marshall-Wells Co. 0,000 Aleeck, Downing & Wright 0,000 Standard Sanitary Mfg. Co. 0,000 American Radiator Co. 0,000 M. Barde & Sons
Portland purchases and pay-roll	00,000	00,000	00...	
	000,000	000,000	00	
Walworth International Co.				
Purchases and pay-roll (exclu. pipe)	00,000	00,000	00....	Includes $0,000 C. S. Grant & Co. 00,000 U. S. Steel Products Co. 0,000 John Simmons & Co. 0,000 National City Bank 0,000 First National Bank
To Walworth Mfg. Co.	00,000	00,000	00	
	000,000	000,000	00	
Grand Total (ex. fin. exp. and cap. and other chgs.)	$0,000,000	$0,000,000	0	
Less intercompany	000,000	000,000	00	
Total net outside (ex. fin. exp. and cap. and other chgs	$0,000,000	$0,000,000	0	
Financial Expense				
Interest payable on notes	$00,000	$0,000	00....	Includes $0,000 Transferred from C/R book.
Insurance	0,000	0		
General office equipment	000	000	0	
Branch equip't def. charges and rent (ex. B. B.)	00,000	00,000	0	
State of Oregon license fee	000	0		
Bond proceeds	000	0		
Expense—bond issue	0,000	0		
Special audits, etc.	0,000	0		
	$0,000,000	$0,000,000	0	

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finished inventory exactly the amount to be withdrawn against orders just received.

Actually, however, this cannot be so precisely manipulated, for product is sometimes months in its period of manufacture, meaning a large "in process," or "in work," inventory; and, further, at rush seasons equipment limitations may not permit production of finished goods at the current high rate of incoming orders. Consequently, the amount of "in process" must be increased in anticipation of increased orders, and subsequently the finished production rate will rise to increased levels. The effort is naturally toward a smoother production rate, made possible if the inventory increases and if the higher production rates are effected in advance of the peak orders.

For the purpose of preparing this chart analysis, it is assumed that the order rate had been estimated, and therefore that this anticipated order level may be plotted on this chart. At any current point of time the two most important of the remaining factors of production and inventory control, are:

1. The increasing or decreasing quantity of unfilled orders which may require a production rate above or below the anticipated order rate.
2. The amount of work already on the way "in process" which will become "finished stock" at the contemplated production rate, and which may apply against the total "fund of orders" (namely, the anticipated orders, plus the unfilled orders carried over from the previous period).

This chart is designed to bring together in comparable form all factors bearing upon the situation, but to emphasize for impression at a glance the current status of these two factors considered most important. This impression is quickly gained through noting the increasing or decreasing width of the two shaded areas.

Since the inventory curves in the "A" (upper) portion of the chart are interpreted in the light of the rates shown in the "B" (lower) portion, the explanation will cover this lower portion first.

The heavy full line "O" shows monthly order rate, the line being extended forward to cover future months for which the month's order rate has been estimated.

The "A_1" light, dotted horizontal lines between the

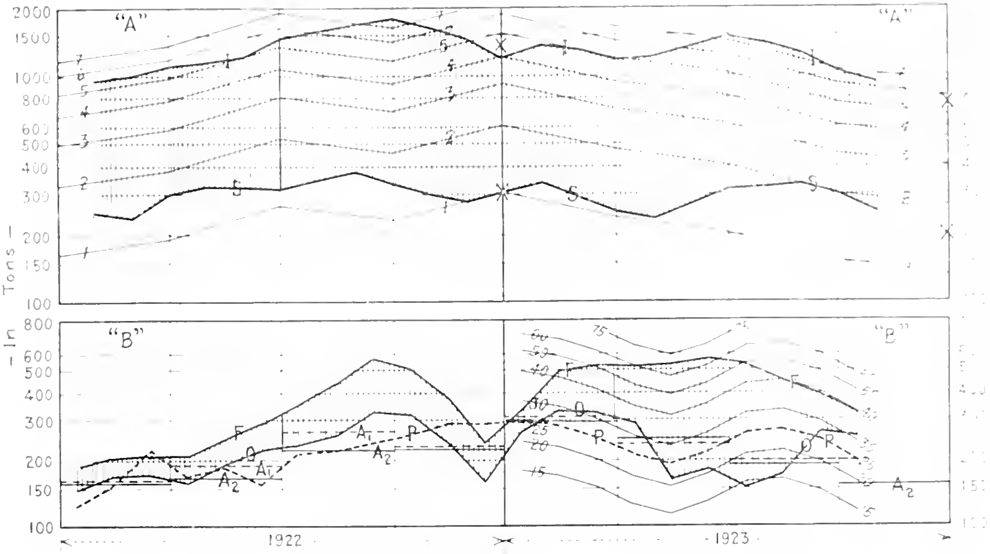


FIG. 14 INVENTORY AND PRODUCTION RATE ANALYSIS FOR PRODUCT CLASS D

quarter-year division lines, show the level of average monthly orders, actual for the quarter.

The "A_2" light, full horizontal lines between the quarter-year division lines, show the level of average monthly orders, estimated for the quarter.

The "F" upper, heavy, full line shown indicates the monthly level of the current "fund" of orders against which that current month's production may be sustained. This fund of orders comprises the current month's incoming orders plus the first of the month unfilled orders balance.

The "P" heavy, dotted line shows the monthly production rate, the line being extended forward to cover future months for which the month's production rate has been authorized.

The upper, or "A," portion of the chart shows inventory conditions interpreted in terms of the rates shown in the "B" portion.

The upper, heavy, full line "I" ("A" portion) shows the level of end of the month inventories of all kinds, including "in process."

The lower, heavy, full line "S" ("A" portion) shows the level of end of month inventories of stock (finished goods).

The tonnage level represented by the inventories at any point may be read from the marginal scales horizontally to the left or right.

In the "B" portion of the chart, the shaded area emphasizes the current status of the first of the month unfilled orders balance, which may justify production in excess of the current order rate. The varying width of the shaded area naturally indicates the increasing or decreasing trend of the balance.

If the dotted production rate line enters this shaded area, it is a signal that at least a portion of the production for that class of product should be very definitely directed against specific items of shortages. If the

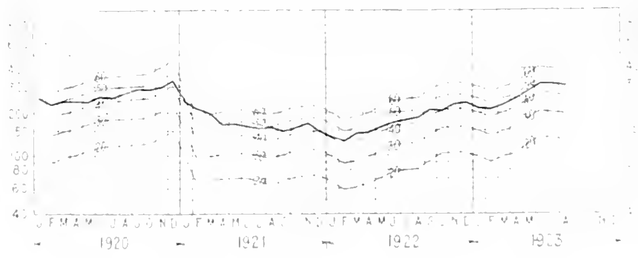


FIG. 15 CHART FOR CURRENT OBSERVATION OF COMBINED ACCOUNTS RECEIVABLES

The heavy line represents the end of month balance of total customers receivables, including open accounts, notes, trade acceptances, and drafts, if any. The figures exclude reserves. The level of the receivables at any point may be read from the marginal scale horizontally to the left or right from the point plotted for the month. The light lines which are always parallel to each other, although they are at constantly varying levels upon the chart, represent 20, 30, 40, etc., working days' sales at the going rate. That is, the daily rate of sales which should be compared with end of December 1920, receivables is the average daily rate for the two months next previous, inasmuch as it is the sales of these two months which contribute almost wholly to the receivables on hand at the end of the two months. The levels of the light guide lines representing 20, 30, 40, etc., times this daily rate of sales for November and December 1920, are located directly under or over the December 1920, receivables period. As the daily rate varies, the light guide lines rise and fall on the chart, but they always are parallel to the daily rate line (not shown) and they always permit direct reading of the number of working days' sales tied up in receivables at the end of any given month.

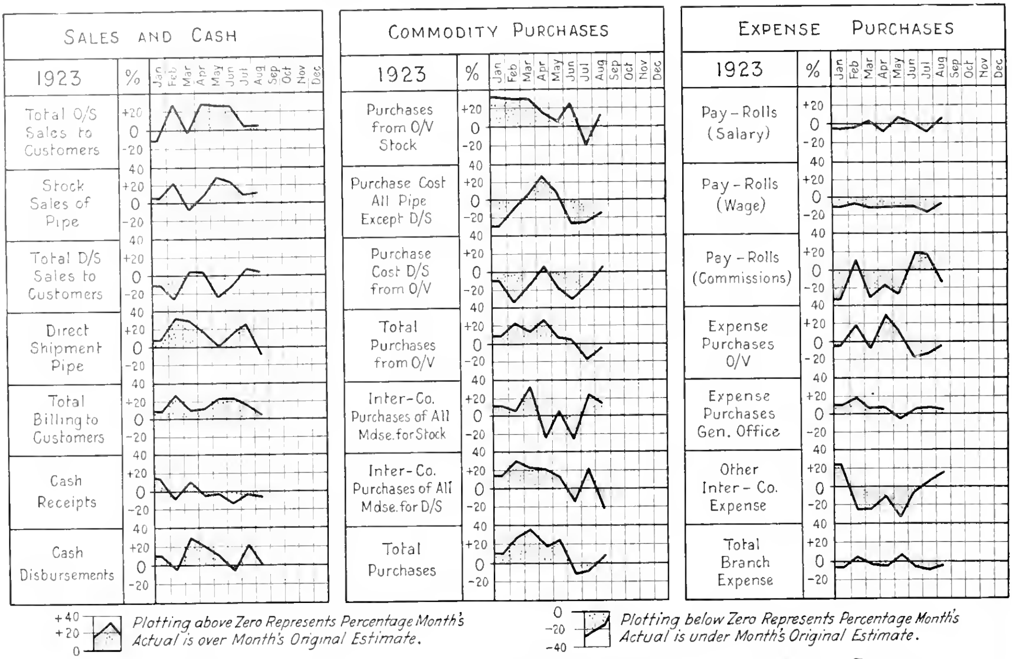


Fig. 16 Budgetary Performance Chart Showing Variation of Actual from Estimate in Percentage

dotted production line is headed toward the upper section of this area, particularly if the area is decreasing, it would indicate the need for production curtailment, unless it could be established that finished stock inventories should be increased in anticipation of later peak orders.

In the "A" portion of the chart, the shaded area emphasizes the difference between all inventories and only stock inventories, or indicates in other words all "in process" inventories. The varying width of this area indicates the varying proportion of "in process" to finished stock, not the varying actual amount. This charting therefore emphasizes the need of increasing the "in process" inventories by greater amounts than finished stock, if it is intended to sustain finished stock at increased levels; and, contrariwise, the need of curtailing "in process" by greater *amounts* than finished stock reduction if adequate proportional relations are to be maintained against a decreased order rate.

To signify better the meaning of present inventory levels it is assumed that inventories are maintained because of coming orders. For convenience, the average monthly order rate in the next following three months is assumed as the basis for graphically suggesting the inventory turnover. The graphic suggestion is conveyed through the light figured guide lines, running over the upper portion of the chart, and numbered 1, 2, 3, etc.

These guide lines locate the levels on the chart represented by 1, 2, 3, etc., times the average rate of orders for the next following three months. This enables, first, a direct reading of the number of months' inventory on hand, for combined, for stock only, or for "in process" only, inventories. Secondly, since order rates for coming quarters are already estimated, and since normal turnover relations under previous similar conditions can be observed from the chart, it is possible graphically to picture the inventory marks (crosses) which should be, and can be, attained by the end of the year.

In the lower portion of the chart, to suggest more definitely the meaning of the current or contemplated production rate, in terms of the current or contemplated order rate, and of the total order fund, light guide lines are drawn on the chart parallel to the recent production or "P" line. The "P" line is taken to represent at all times 25 days' one work-month's production, or 25 times the going daily rate of production. It is then a simple property of the ratio chart which enables the location of the light lines paralleling the "P" line at intervals representing 15, 20, etc., times the daily production rate.

It is then possible to read directly from the chart that the July total order fund, or "F" line, for the month, represented 50 days', or two months', production at the July production rate, although actual current incoming orders represented less than 15 days' or about one half-month's production at the going rate.

It may be added that in this particular class of product there is some early placing of orders for deferred shipment. It is therefore noted that, although June-July production exceeded the June-July actual order rate, deferred shipments necessitated that the production go into stock, thereby failing to reduce the unfilled orders balance. Nevertheless, as assurance developed that regular fall orders would show the seasonal peak, July-August production was sustained against those anticipated orders.

Now in view of anticipated fourth quarter seasonal decline in orders, the contemplated October production rate reflects a conservative tendency in view of the inventory mark set for the end of the year.

As already stated the first introduction to this style of chart suggests a complexity of factors and of lines representing them. But it must be realized that the chart is a monthly report, and that this chart is but one out of a series summarizing multitudinous details for the executives' attention. The design enables a hasty scanning of the latest current month's postings only. And, even with these, the initial glance searches:

1. For widening or narrowing areas—*changes* from the previously accepted condition.
2. For the trend of the dotted line into, or out of, the shaded unfilled order area.
3. For exceptions to the anticipated working out of authorized production and inventory policies.

Only in the case of the exceptions is the detail of the chart noticed. But then there is available sufficient detail to suggest at once why we have developed our present position and whither we are inevitably trending.

Action may then be immediate for the chart is based upon assembled facts and estimates, recorded as to their sources. The cause for the [illegible] condition revealed by the [illegible] through [illegible] there may be promptly [illegible]

Again, Fig. [illegible] shows [illegible] chart for current observation of [illegible] tables, including all [illegible] chart for each sales unit, and one [illegible] all sales units. In the executive hands, the [illegible] of charts is quickly reviewed each month. A [illegible] observation indicates whether the unit's receivables [illegible] is tending toward a lower "number of days" [illegible] an improved condition—or whether it is tending toward a higher guide line—a condition requiring explanation.

One final exhibit, Fig. 16, shows the form of a performance chart sent to the estimators. The purpose here is to aid the estimator, who may observe now the theory back of his estimate has, or has not, become a tangible fact in the present, and to what extent he must revise his earlier anticipations in view of real conditions as they are developing. This desirable performance comparison with estimate is given upon each important item originally estimated upon, and the comparison is presented in simple graphic terms, very readily grasped. In addition to the value to the estimator of such a check-up in the "present" of what was previously only an "estimate," the set of performance charts aids the major executive in noting which estimator's figures most often approximate actual, which are most often optimistically high, and which tend to underrate possibilities.

Strange Uses of Common Materials

By EDWARD R. WEIDLEIN

Director of Mellon Institute of Industrial Research of the University of Pittsburgh

Index Number
66 Chemical technology
658.57 Industrial research

NOVEL uses are constantly being sought for common substances, both natural and manufactured, to increase the markets for them. In consequence, new applications, some of which appear strange, are being reported constantly. Many such unique uses are of ephemeral interest to industry, but some of them are of permanent value. The odd and curious uses of today very soon lose their strangeness when they become generally known through successful introduction.

Certain uses of common materials which may seem strange because they are unusual will now be described briefly. There are a great many interesting applications of this general character; but mention will be made of a few types which illustrate novel and important uses, to give variety rather than scope, in the special field of chemical technology. All the applications included have been found by systematic industrial research.

Sulfur, which is produced in enormous quantities in Texas by melting it in the earth and forcing the fused mass to the surface, is probably the most familiar nonmetallic element because of its tonnage uses for so many important purposes. As in the case of many other common substances, it also has some unique applications, its use as a "fertilizer" in agriculture being outstanding in this respect.

The work of Dr. J. G. Lipman and his associates at the New Jersey Experiment Station on the bacterial oxidation of sulfur, which has been going on since 1916, is being developed in the practical direction. The extraordinary organism *Thiobacillus thio-oxidans* is a most active oxidizer of elementary sulfur, and treatment of soil with sulfur in the presence of this organism is being advocated for several purposes, such as: (1) to control potato scab; (2) to reclaim black alkali soils; and (3) to increase the availability of phosphates. It has been demonstrated that, by treating soil with inoculated sulfur, the acidity of the soil can be increased sufficiently to inhibit the growth of *Actinomyces scabies*, the organism responsible for potato scab.

The unique metal mercury, or "quicksilver," is, like water, a liquid and, like water, it may be used in generation of power. Mercury vapor has a much greater density than steam and a lower heat of vaporization. Hence it may be used in a high-temperature turbine of simple design. In fact, a mercury turbine and boiler are now being developed by the General Electric Company.

This application of mercury gives promise of practical results in the way of a successful prime mover with an efficiency comparable with that of the Diesel engine. Moreover, this high efficiency may be attained with solid fuels, whereas the Diesel engine is limited to oil. The fuel will be burned in the furnace of the mercury boiler. In central stations, the present steam turbines can be used and only the boilers need be removed and replaced by the mercury equipment.

Curious Uses of Common Salt

Common salt is regarded as one of the most important mineral products because of its essential uses in the food, chemical, and metallurgical industries; but it has several applications which are but little known to the general public. To illustrate, it may be used in agriculture as a fertilizer, soil amendment and weed killer, and in the preparation of an improved whitewash.

Whitewash is the cheapest of all paints. Lime, which is the basis of whitewash, makes a very sanitary coating, and is to be preferred for some cellars and the interiors of certain types of outbuildings. Whitewash is also extensively used for coating the exteriors of sheds and fences. Straight lime wash is greatly improved by the addition to it of a small amount of common salt. The effect of salt has been explained by the fact that it enhances the solubility of slaked lime, the degree of penetration into the wood thus being increased. Then, too, the presence of salt tends to retain moisture and facilitate carbonation of lime subsequent to applying the whitewash.

The prevention of corrosion of iron and steel commodities is a very serious problem all over the world, but the great majority of people in civilized countries are probably more personally interested in the elimination of corrosion in their hot-water supply systems.

Many methods have been employed to mitigate the evils of corrosion, but the most common practice has been to apply one of the numerous protective coatings to the surface of the iron or steel pipe. These coatings may be metallic or non-metallic. Among the metallic protective materials are zinc, aluminum, and lead, while the chief non-metallic coatings are Portland cement and the various coal-tar and asphaltic preparations.

All the above-mentioned coatings are very effective in preventing corrosion while they last, but none of them is by any means permanent. Every one of them must be applied to the pipe before it is put into service and, therefore, once the water has eaten through the protective material, there is no chance for its renewal. This defect of most artificial coatings suggested the desirability of a protective coating which could be applied continuously or intermittently after pipe had been in service in a hot-water supply system.

With this object in view, a particular line of investigation was undertaken to find some material which, when added to the water heater, would be carried throughout the system and be precipitated upon the internal walls of the iron or steel pipe in the form of a "self-healing" protective film. From this research it developed that fused silicate of soda, or common "water-glass," most nearly met the requirements called for, and, in consequence, this chemical is being used today as a practical means of preventing corrosion in hot-water supply systems.

This value of silicate of soda lies in the fact that it is readily carried in solution by the hot water throughout the system, and is precipitated by combining with colloidal iron or soluble salts in the water in the form of an impervious film, which prevents the corrosive water from coming into actual contact with the metal. One very important advantage of this process is that the treatment can be either continuous or intermittent, as is found necessary, the color of the water being a very good indication as to just how to manipulate the treatment. However, caution must be exercised in using this treatment. It is only applicable to small buildings wherein the hot-water supply lines are comparatively short, and not to large systems. In the last-mentioned case, the only safe way of preventing corrosion is to install one of the several methods for removing the dissolved oxygen from the water. The deoxidation method costs too much to be used in small buildings, such as laundries, apartments, and private houses.

Nickel and Hydrogen in Vegetable Oil "Hardening"

Unsaturated compounds of the fatty acid series unite directly with hydrogen, or become hydrogenated, in the presence of suitable catalyzers, to form saturated bodies; for example, oleic acid ($C_{18}H_{34}O_2$) is converted into stearic acid ($C_{18}H_{36}O_2$), and olein yields stearin, both of which have greater commercial value because of their higher melting-points. Nickel has been found to be the most suitable catalyzer and is used as a finely divided, metallic deposit upon an inert support, such as pumice-stone or infusorial earth.

The oil which is to be treated is mixed with nickel catalyzer and introduced into a vessel where it can be subjected to hydrogen at about 175 deg. to 200 deg. cent., under pressures ranging from atmospheric up to 25 lb. per sq. in. The operation is continued until test portions show that the fat has acquired a sufficiently high melting-point, when the hot oil is filter-pressed to remove the catalyzer, and then cooled. Vegetable oils, such as cottonseed oil, are converted into solid fats ("hardened") by this treatment. These products now find extensive employment in the preparation of lard substitutes and other food products, and for soaps, and in making lubricants. "Thickened" cottonseed, peanut, sesame, and other edible oils are used in place of oleostearin from tallow in lard compounds.

The rapidity of the technical application of this discovery has been phenomenal, as is made clear by the fact that only three plants were operating in 1910, and they were struggling with the various difficulties of the process, whereas, after 12 years, no less than about 75 factories were forced, by their very efficiency, to restrict their own operation. There is no doubt that, given the necessary stimulus provided by sufficient price margins in the oil and fat markets, progress will be made on the lines of a continuous hydrogenation process.

Effect of the Federal Reserve System on Interest Rates

By W. RANDOLPH BURGESS

Manager, Reports Department, Federal Reserve Bank of New York

Index Number
332.11 Federal Reserve System
332.7 Credit

ANY discussion of the effects of the operation of the federal reserve system on interest rates or other aspects of the financial life of the nation may seem to be premature. The federal reserve system is just less than 9 years old. Each one of its 9 years has been a year of unusual events. It began operations 3 months after the outbreak of the World War. During the war the reserve banks were forced by circumstances to extend credit to an extent probably not dreamed of by the authors of the legislation establishing the system.

After the war have come years of readjustment in an economically disordered world—a larger and more rapid decline in prices than has ever before taken place in this country; a maladjustment of prices resulting in a severe strain on the agricultural population; and a dislocation of the ordinary world machinery for financing foreign trade, which shifted many of the responsibilities of world banking from London to New York.

These 9 years are hardly the background for a final judgment as to what is to be the normal peace-time effect of the operations of the federal reserve system, but they did provide a searching test of the ability of the system to meet emergency conditions; they indicated the scope which its activities might cover; and they furnished at least some evidence as to the effect of the operations of the system on the money markets.

Effect on Average Level of Rates

There is no good reason for believing that in the long run the federal reserve system will have any large effect in changing the average level of interest rates. On the whole, interest rates are determined by the amount of money which capital can earn and by the supply of, and demand for, capital. If money invested can earn on the average 5 per cent for the person who invests it, the average interest rate for any considerable term of years will be in the neighborhood of that figure, plus the cost of risk and administration. Particularly for shorter periods large demands for capital will drive the interest rates up or large supplies of capital tend to bring rates lower. But for a long term of years the major factor in setting rates is the return which the business of a country yields.

This may be illustrated by comparing the money market in London and New York. Interest rates are typically 1 or 2 per cent lower in London than they are here, and the main reason appears to be that the long established businesses of the British Isles operate on a comparatively narrow margin of profit, whereas in this developing country the usual rate of return on capital invested is larger. The second reason for the difference may be found in the fact that the supply of capital in London is always larger than the current domestic demand, whereas in this country the development of our natural resources has until recently absorbed all our available capital and we have usually been borrowers from abroad in addition.

The establishment of the federal reserve banks does not directly affect the rate of return which business men receive on their invested capital, and over a term of years it scarcely affects the total available supply of capital. Through its facilities for the expansion of credit and currency the reserve banks are able temporarily to increase the available supply of funds by several billions of dollars. Any such increase, however, is or should be temporary and is small compared with the total supply of capital in the country. Our national wealth is variously estimated at anywhere from 300 to 500 billion dollars. The amount of outstanding bond issues, without including stocks, is probably in the neighborhood of 40 billion dollars. So the additional funds which the federal reserve system may furnish temporarily to meet emergency conditions are not likely to have any lasting effect on the general level of interest rates.

For the 9 years, during which the federal reserve system has been in operation, the average level of interest rates has been neither markedly higher nor lower than the average level for the preceding 20 or 30 years. These facts are illustrated in the accompanying diagram Fig. 1, of the high, low, and average interest rates on 60- to 90-day commercial paper each year from 1831 to 1920.[1] A small circle shows for each year the average interest rate, and a vertical line shows by its extent upward the highest rate for the year, and by its extent downward the lowest rate. Since the years before the Civil War there has been in general a downward trend of interest rates in this country and particularly a reduction in the extreme fluctuations both above and below the average. In the decades from 1830 to 1860 interest rates of as high as 15 per cent or over were not infrequent and there were two years, 1836 to 1848, where the average for the entire year was above 15 per cent.

[1] Throughout this article open market interest rates on commercial paper have been used as representative of the course of interest rates. Commercial paper is the most common form of security for short time loans in this country. The open market rate moves somewhat more rapidly than bank discount rates, but represents rather accurately the state of the money market. The quotations are available much more readily and accurately than those for any other type of paper.

The causes for the greater stabilization and lower level of interest rates, as years have gone on, may be found in the first place in the character of industrial and business enterprises in this country. We are constantly reaching a better degree of industrial stabilization and are leaving behind much of the speculation and experimentation which accompanied the early development of national resources and early experiments in factory production. The result is a steadier return on invested capital, but a lower return.

A second cause may be found in the perfecting of the organization of the money markets, which are the mechanism by means of which surplus funds are made available to meet the needs of commerce, agriculture, and industry. Before the Civil War the national banking system was not established; the security markets were far from their present state of organization; there were no open markets for bankers' bills, or government securities. As a consequence there was no easy way by means of which the borrower and the lender could be sure of meeting each other under satisfactory conditions and there was chronically either a plethora or a scarcity of funds. A third cause for more stable money conditions in recent years and lower money rates may be found in the gradual accumulation of capital available for investment, accompanying the increase of wealth of the country.

It is on the fluctuation of rates rather than on their average level that the federal reserve system might be expected to have an important influence, and in this respect the system is a further development in line with those just cited which have steadied the fluctuation of rates. The reserve system has made still more rapid and direct the contact between borrower and lender and in addition has made it possible to expand and contract the supply of funds in keeping with the needs of business and agriculture. The two contributions of the reserve system may perhaps be remembered best by the terms *fluidity* of credit and *elasticity* of credit.

Fluidity of Credit

Frequently in times past money was easy in New York when it was tight in Chicago, or vice versa. There were regularly times of the year when New York funds sold at a premium in Chicago, or Chicago funds at a premium in New York just as under normal conditions there were times when dollars sold at a premium in London or Paris. The establishment of the national banking system during the Civil War and of the succeeding growth of correspondent relationships between banks in different parts of the country which enabled them to assist each other in time of need provided one means for meeting these conditions. These relationships were dependent, however, on the initiative of individual banks and their confidence in other banks at a considerable distance. The only method of final settlement was the expensive shipment of gold or currency from one part of the country to another. It was not possible by these means to avoid wide fluctuations in rates due entirely to temporary local causes.

The federal reserve system places at the command of member banks a mechanism for the free movement of funds between different parts of the country. In the first place the reserve banks collect for member banks checks drawn on banks in all parts of the country and collect them much more rapidly than before the system. Interdistrict transactions are thus facilitated and the risk which accompanies delay in settlements is reduced.

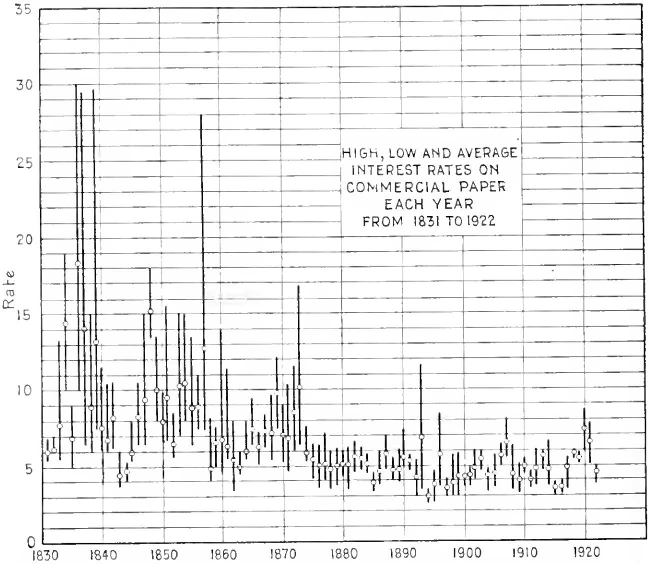


FIG. 1 INTEREST RATES ON 60-90 DAY COMMERCIAL PAPER IN THE OPEN MARKET

Small circles show average rates each year; tops of lines show highest and bottoms of lines lowest rates. Figures for early years in this and Fig. 2 are taken from a study by Dr. F. R. Macaulay.

In the second place the twelve federal reserve banks, located in different parts of the country, maintain in Washington a gold fund which at the present time amounts to about $650,000,000 and, instead of shipments of funds from one part of the country to another being necessary, funds may be transferred simply by a bookkeeping transaction which changes the ownership of the gold fund between the federal reserve banks. By this means the settlement of interdistrict balances resulting from the collection of checks is effected, and through this means, also, funds may be transferred by telegraph from one district to another almost instantly and without cost to member banks.

Beside facilitating the transfer of funds between districts in the course of ordinary banking transaction the federal reserve banks in different districts stand ready to lend to each other in case of need. Thus in January 1920, when the needs of business caused an urgent demand for funds in New York, the Reserve Bank of

Atlanta, which was not hard pressed at that time, loaned a total of $25,000,000 to the Federal Reserve Bank of New York to meet the needs of its member banks. Similarly in the summer of 1920 when money was needed to handle the cotton crop, the Federal Reserve Bank of New York loaned $11,000,000 to the Reserve Bank of Atlanta.

The federal reserve system has no power to level out the differences in interest rates which are due to permanent local conditions such as the higher cost of banking operations in rural communities. What it does is to create a channel of free communication by which

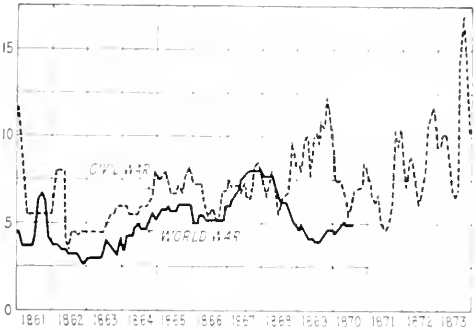


FIG. 2 AVERAGE MONTHLY INTEREST RATES ON 60-90 DAY COMMERCIAL PAPER DURING THE CIVIL WAR AND WORLD WAR PERIODS

the impediments of time and distance are reduced. The normal effect is a reduction in rate fluctuations.

Elasticity of Credit

The full utilization of available credit resources by making them fluid is one thing; the expansion or reduction of the total volume of credit is quite another thing. The federal reserve system is designed to serve both these purposes. Not only does it facilitate the free movement of funds about the country, but it may also expand or diminish the total amount of funds available. Expansion is effected by lending to member banks who present for rediscount or as security for loans government securities or customers' paper which meets certain eligibility requirements. By means of such loans balances are created for member banks which may be counted as reserves or against which they may draw currency. The amount which the reserve banks may lend to member banks through rediscounting is limited by law by the requirement that a 40 per cent gold reserve be maintained against all federal reserve notes issued and a 35 per cent reserve of gold on lawful money maintained against the reserve deposits of member banks. Banks nearly always hold large amounts of government securities or commercial paper of the type which is eligible for rediscount at reserve banks. Under these limitations the total loans of the reserve banks reached 3½ billions of dollars in 1920. And the loans which member banks were enabled to extend to their customers were several times that amount.

Thus to meet periods of emergency the reserve system can, through its loans to member banks, largely increase the available supply of funds. It is generally recognized by member banks that they should only borrow from the reserve banks to meet temporary need and the reserve banks have the power to control the amount of lending to members by changes in the rate of discount which they charge. Thus far credit expansion through the reserve banks has taken place only in periods when the increasing demands of business made it necessary and gradual reabsorption of credit has followed the passing of the need. This cushion of credit which the system provides seems likely to affect profoundly the fluctuations in interest rates. There may be times when member banks will not be borrowing at all from the reserve banks. In that case, of course, the presence of the reserve system would have little effect on rates except as the reserve banks purchased or sold securities in the open market. As a matter of fact borrowing has been continuous except for a few months in the early days of the system.

Reduced Fluctuation in Rates

Under any but extraordinary circumstances the ability of the reserve banks to provide an additional supply of funds to meet the needs of member banks will tend to prevent extraordinarily high fluctuations in interest rates. Conversely the reabsorption of this credit by the reserve banks after the need has passed and as member banks repay their borrowings will tend to prevent the occurrence of very low fluctuations in interest rates. The normal effect would be to cut off the extremes of fluctuation and leave the average rate little changed.

This theoretical expectation of reduced fluctuations in rates as the probable effect of the reserve system may be tested somewhat by the experience of the 9 years in which the system has been in operation.

To find a period of economic disturbance in any way comparable with the World War it is necessary to go back to the Civil War. Fig. 2 brings together lines tracing the course of average monthly interest rates during and after the conclusion of the Civil War and the World War. The line made up of dashes shows that the Civil War period was marked by violent fluctuations in rates, whereas the course of rates in the World War period was far steadier and never reached such high peaks.

As has been indicated earlier in this article the difference between the movement of rates now and in earlier periods can be ascribed partly to the federal reserve system and partly also to a more nicely organized banking system and money and security markets. There is no way of assigning to each of these its part in the change. The presence of the federal reserve system is one cause among several which would logically make for stability.

There is another feature of the diagram which is worthy of notice. During the Civil War period there was a marked seasonal movement of rates; rates practically always rose in the fall and early winter and were almost always low in the summer. In marked contrast rates in recent years show no regular movement such as might be ascribed to seasonal causes.

If we examine the monthly changes in interest rates not simply in the Civil War period but in the years immediately before the reserve system was established, we discover a marked swing in rates which regularly characterized different seasons of the year. One cause of this swing was to be found partly in the dominance of agriculture in a large part of the country. Funds are needed in large amount as planting is begun and again to carry through the harvest, while at other periods the demand is smaller.

Such seasonal variation in the demand for funds is perhaps as great in industry and commerce as in agriculture. Seasonal changes in the volume of transactions in important lines of business are illustrated in Fig. 3. In each case the figures for a number of years are averaged in order to secure the typical seasonal variation.[2] The columns show the percentage of the year's business in different lines which is done in each month of the year.

Sales by department stores are customarily more than twice as large in December as in July or August. Sales by wholesale dealers reach their high point a few months earlier when retailers are stocking up for the Christmas trade. Car loadings are largest in October when the wholesale movement of goods is large and when coal shipments are heavy anticipating winter needs. Applications for building permits and the awarding of contracts are heaviest in the spring. Bank clearings show less fluctuation, but are heaviest in October and December in the country outside of New York City and in December and January in New York City. The figures illustrated in Fig. 3 are shown in the following table:

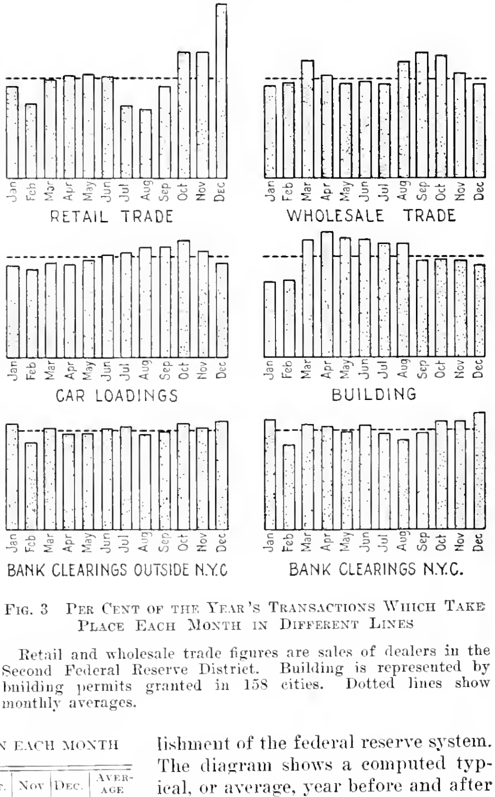


FIG. 3 PER CENT OF THE YEAR'S TRANSACTIONS WHICH TAKE PLACE EACH MONTH IN DIFFERENT LINES

Retail and wholesale trade figures are sales of dealers in the Second Federal Reserve District. Building is represented by building permits granted in 158 cities. Dotted lines show monthly averages.

puted from the tables presented in that volume and compares it with the variation in rates after the establishment of the federal reserve system. The diagram shows a computed typical, or average, year before and after the federal reserve system began active operations.[3] In each case the average rate for the year is taken as 100 per cent and the figure for each week is shown as a percentage of this annual average. The first line shows that before the federal reserve system there was typically a 25 to 35 per cent variation in the rate from one time of year to another. If the rate was 3 per cent in the summer it tended to rise to about 4 per cent in the late fall.

TABLE 1. PER CENT OF THE YEAR'S BUSINESS WHICH IS DONE IN EACH MONTH

	JAN	FEB.	MAR	APR	MAY	JUNE	JULY	AUG	SEPT.	OCT.	NOV	DEC.	AVERAGE
Retail Trade	7.4	6.1	8.0	8.4	8.5	8.3	5.9	5.6	7.4	10.2	10.1	14.1	8.3
Wholesale Trade	7.3	7.6	9.4	8.2	7.5	7.7	7.5	9.3	10.0	9.8	8.3	7.4	8.3
Car Loadings	7.5	7.3	7.8	7.7	8.1	8.5	8.7	9.2	9.2	9.6	8.7	7.7	8.3
Building Permits Granted	6.1	6.2	9.5	10.2	9.6	9.5	9.2	9.1	7.7	7.9	7.7	7.3	8.3
Bank Clearings (Outside N. Y.)	8.8	7.3	8.5	8.0	8.0	8.4	8.5	7.9	8.2	8.9	8.4	9.1	8.3
Bank Clearings (N. Y.)	9.1	7.0	8.7	8.5	8.1	8.5	7.9	7.4	7.8	8.8	8.8	9.4	8.3

These seasonal changes in the volume of business result in seasonal changes in the amount of credit required. Under the old scheme of things the volume of credit was inelastic and sluggish of movement. It could not be varied in amount rapidly to meet changing needs; it could not be shifted about the country rapidly. As a consequence the seasons of greatest need were periods of tight money and correspondingly high interest rates. When the report of the Monetary Commission of the Senate was prepared prior to the establishment of the federal reserve system the seasonal variation in interest rates was regarded as of sufficient importance to justify devoting to it one of the largest volumes of the report. Fig. 4 illustrates the seasonal variation in rates com-

This variation was most important when it occurred simultaneously with some business crisis. Seasonal money stringency was an influential factor in the final crash in 1907. Even under ordinary circumstances the fluctuations in rates were a disturbing factor to be reckoned with seriously. The changes bore most heavily on those who were forced to borrow when rates were highest. Many business men could adjust the conduct of their business so as to do their borrowing when money was cheap. It was the inflexible occupations like agriculture which suffered most.

[2] By way of technical explanation it should be stated that in most cases the precise statistical method employed was to find the median deviation from a twelve months' moving average centered on the seventh month.

[3] The method of computing seasonal variation is the same as that used in Fig. 3.

The federal reserve system by making bank credit fluid and elastic has much reduced the credit strain due to seasonal causes. When funds are needed in the agricultural west and south they can readily be transferred from the industrial east and north, and vice versa. When the total supply of credit and currency is inadequate for current needs it can be supplemented by credit and currency obtained from the reserve banks. As the line in the chart shows, rates have been nearly free from seasonal changes in the seven years shown. It is true that these were years of unusual events, but even in unusual years before the federal reserve system seasonal rate changes were marked. The figures are not

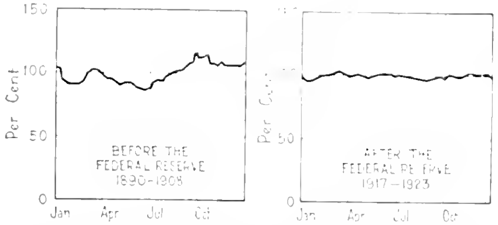


FIG. 4 TYPICAL SEASONAL VARIATION IN OPEN MARKET INTEREST RATES FOR 60-90 DAY COMMERCIAL PAPER BEFORE AND AFTER THE ESTABLISHMENT OF THE FEDERAL RESERVE SYSTEM

Average rate for each year=100 per cent.

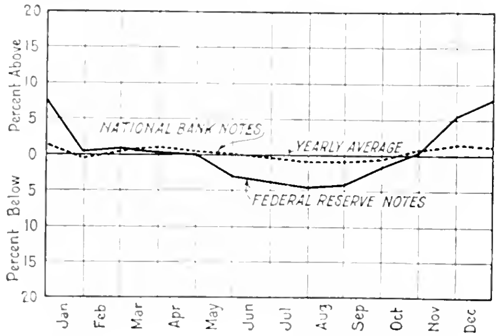


FIG. 5 SEASONAL VARIATION OF FEDERAL RESERVE NOTES (1915-1922) COMPARED WITH THE SEASONAL VARIATION OF NATIONAL BANK NOTES (1900-1914).

sufficient to justify a precise statement of the extent to which seasonal fluctuations have been eliminated, but they are sufficient to demonstrate beyond reasonable doubt a considerable reduction in seasonal change.[4]

Seasonal Changes in Currency

The means by which the reserve system has influenced rates may be illustrated most clearly in the case of currency. The most elastic element in the regular currency of the United States, previous to 1914, was the national bank note. The instrument of currency expansion at present is the federal reserve note which now [illegible] in [illegible] inelastic [illegible] years from 1900 to 1914 [illegible] the annual [illegible] notes are [illegible] currency and [illegible] commonly from 4½ per cent below [illegible] the annual average. To put it [illegible] the amount of notes in circulation is from 10 to 12 per cent larger in the midst of December Christmas trade than in midsummer. These facts are illustrated in Fig. 5.

This elasticity in the volume of money which may be placed in circulation through borrowing at the reserve banks, together with a similar possibility of supplementing member bank reserves, and the freer flow of funds about the country, have been the factors which have greatly reduced seasonal credit strain.

The existing experience with the federal reserve system as far as it may be summarized statistically indicates that the system is in fact producing those results which its founders had in mind. It has provided an elastic currency. Through the discounting of commercial paper certain of the credit strains to which the country was subject have been lessened. As more experience accumulates a broader judgment will be possible. In particular we shall be able to observe more definitely the effect of the operations of the system on the fluctuations of interest rates which accompany the round of economic events known as the business cycle. As far as the evidence now goes the reserve system is accomplishing its purpose.

Effect on the Discount Rate

We have thus far considered the effect of the federal reserve system on interest rates solely through its power to encourage the free flow of funds and to expand and contract the supply of credit and currency. It is clear that the discount rate, or the price charged by reserve banks for the credit or currency they lend to member banks, is influential in determining how much credit or currency a member bank borrows and affects the market rate immediately. If the discount rate were considerably lower than the market rate for money, large borrowing would be encouraged and for a time market rates would be lower. On the other hand if rates were maintained far above the market, borrowing would be restricted and market rates for money would tend to be high.

As a matter of practice the federal reserve banks have endeavored to arrange the discount rate to disturb the money markets as little as possible and the rates have tended to reflect existing credit conditions. The reserve banks have endeavored to make additional credit available at a rate consistent with the market rate; so that the amount of borrowing by member banks will be determined by the genuine needs of agriculture and business. This policy is in accordance with the Federal Reserve Act which states that the federal reserve banks may "establish from time to time, subject to review and determination of the Federal Reserve Board, rates of discount to be charged by the Federal Reserve Bank

[4] The Harvard Economic Service has estimated that the seasonal movement of interest rates has been reduced by one-half since the establishment of the federal reserve system.

for each class of paper, which shall be fixed, *with a view of accommodating commerce and business.*" If there were marked departures from this policy any discussion of the effect of the federal reserve system on interest rates would have to deal largely with rate policy. Under conditions as they have been the picture is reasonably complete with a consideration of the effect of the system through creating fluidity and elasticity of credit and currency.

In conclusion, for the benefit of the busy executive who must read as he runs, this article may be summed up as follows:

1. Nearly 9 years of operation of the federal reserve system indicate the probable scope of its activities and furnish evidence for tentative conclusions as to its effect on the money market.
2. The reserve system is likely to have little effect on the general level of interest rates, which are fixed by the amount capital can earn and the demand for and supply of funds.
3. By giving greater fluidity and elasticity to credit the reserve system might be expected to reduce greatly the fluctuations in interest rate.
4. The actual movement of rates in the World War period was much steadier than the movement in the Civil War period, a difference in which the reserve system was an important factor.
5. Since the reserve system has been in operation the seasonal swing in interest rates has been reduced to minor operations.
6. The statistics thus far available indicate that the federal reserve system is in fact yielding the results which might be expected; furnishing fluidity and elasticity of credit and by that means reducing the swing of interest rates.

Postponing the New Office Building

Index Number
651.1 Office Buildings

OFFICE buildings just now are costly. In many cases, although a new administration building may be badly needed, it is better business to wait.

One company found several means of doing without a new building, at only a slight sacrifice of office efficiency. The extensive sample and display room was given up to a working department. Sample cases around the wall are allowed to stay, but a large display table in the center of the floor, and other equipment, have been removed and stored away. The conference rooms were likewise given up to routine office work. Now conferences between executives take place in one of the private offices, and conferences with visitors take place either in a private office or in the reception room.

Private offices of executives had taken up the line along the front outer wall of the office building. Some of the executives abandoned the private office habit and stationed their desks in the midst of their departments; some moved to offices in an adjacent private house purchased and fitted up by the company.

There are two such houses now in use, one on each side of the administration building. One includes offices of department heads. The advertising manager has a secluded domain of his own. Cupboards and closets in the house were fitted up with shelves for advertising supplies, circulars, inserts, booklets, and catalogues. In most offices space is too valuable for the storing of such supplies near the center of activity; they are usually stored in a basement or remote corner.

The office manager has also moved his desk to the former residence house. He is either walking through an office department and adjusting its mechanism, at which time his own desk is of no use to him, or he has retired to his desk for analytical work. At the latter times he is glad to be far away from interruptions.

The manager, his assistant, and others have their offices on the upper floor. The ground floor is given over to the central typing department and one or two smaller departments of the office which are not naturally in the regular routing of documents. Even when it was in the main office, the typing room was reached only by office mail or messenger or by telephone, for dictaphone machines were in use. Such departments are not in the office chain, and can be detached without inconvenience to anyone.

The multigraph department, especially, fitted into the annex, not only because it is a service department to the whole plant, but because a great deal of its work is done for the advertising department, which is now on the upper floor of the annex, and for the typing department on the ground floor. The photographic department also found the former residence very convenient, for the sink in the kitchen was retained when the house was converted to an office, and is used for washing negatives and prints.

The officers of this company recognized that they were the ones who could be most easily detached from the body of the office. None of the routine work goes through their doors. Their only physical connection with the office is by correspondence or through inspection of the departments. Many officials have private stenographers and do not even depend upon the central typing service. Therefore, they gave up their rooms to be turned into routine office departments, and moved to a second house which was fitted up into suites for them. Here they now have not only a private office, but a private house, and though it is within 50 yards of the administration building, it is extremely quiet.

The purchase of these two former residences, together with the abandonment of a small amount of space previously devoted to luxuries, has enabled the company at slight expense to postpone the erection of the new office building until construction costs go down. Meanwhile, a much better plan can be worked out than if the office had been built when it was first needed.

Profit or Loss in Material Handling

False Burden Figures Hide the Truth in Most Plants Today

By JAMES A. SHEPARD

Index Number
657.524 Cost accounting
658.281 Material handling

THE cost system of the average manufacturing plant is inadequate and inaccurate when applied to subdivisions of accounting. Perhaps this statement sounds drastic and will be warmly disputed by executives in industrial concerns. It may even be doubted by some cost men, although generally cost accountants are aware of the limitations of their own systems, but have had neither the time nor the encouragement to develop them into effective units of control.

Probably most manufacturers are familiar with the survey made not long ago by the United Typothetae of New York City [1] which showed that of the plants investigated:

- 56 used standard cost systems.
- 187 had no cost system, but had a knowledge of all general costs.
- 741 had no cost system, but had an incomplete knowledge of all general costs.
- 554 had no cost system and only incomplete knowledge of a few general costs.

This record is by no means peculiar to the industry in question. It can be duplicated in almost every branch of manufacturing. If anyone doubts such a statement he need but question any of the national technical, trade, or cost associations to have it verified. Several trade associations have adopted standard cost systems, but records are meager regarding the extent to which they are in use. Especially, information is lacking as to the accuracy of the relation which such factors as burden bear to any of the elements of direct expense.

A stage has been reached in industry where accurate cost accounting is no longer just a helpful adjunct. It has become a vital necessity. Statistics of business, income tax returns, and other authoritative sources of information indicate that approximately only one enterprise in ten is really profitable. The remaining nine either crawl along barely existing or else ultimately fail outright. Certainly, with the control possible under a thorough cost accounting system, most of the indications of danger would present themselves at a time when the trouble could be overcome. Improvements in method at any point are usually easy of accomplishment when the necessity is clearly pointed out.

In the field of material handling the need of better cost systems is strikingly evident. Growing labor shortage, the demand on the part of workmen to be relieved of enervating drudgery, the desire on the part of employers to substitute positive, tireless and efficient machinery for the human element with its many weaknesses, have all tended toward a concerted effort to introduce this kind of equipment. Labor opposition has, in fact, changed to the attitude that the best equipped plant is the most desirable place in which to work.

But many times the introduction of labor-saving equipment has followed an impulse to improve methods, without the careful calculation and planning necessary to secure the best adapted device. Under such conditions the hoped-for saving has been less than anticipated, has been nothing, or may even have proved a loss. Such a condition is even more to be deplored by the maker of the equipment than by the purchaser. Even worse, the actual saving or loss may be badly distorted from the truth because of inaccurate accounting methods, and the purchaser may be making money while appearing to lose by the change, or losing money on ill-adapted devices while seeming to gain.

Burden Costs Under Hand Methods

The greatest difficulty, however, lies in the fact that, woefully lacking the truth regarding his actual burden costs under hand methods, and believing them to be very low, the manufacturer is often deterred from introducing labor-saving equipment, where the items of burden are much more readily ascertainable, because he himself is unintentionally suppressing the very information which would make the economy self-evident. It is not overdrawing the situation to say that the average manager would be horrified to know what an excessive burden his hand methods of all kinds are placing on his enterprise. Even inefficient mechanical methods impose charges which are needlessly heavy.

In material handling calculation, as in other manufacturing operations, items of direct income and direct expenditure present very little, if anything, that is problematic in the way of fixing a suitable money valuation. Such items, if of income, are in the form of orders or contracts to which a definite money valuation is applied in the ordinary course of business. The same holds true of direct expenditures, for which the inevitable bill arrives, in due course, with an equivalent valuation in dollars clearly in evidence.

But cost accounting must allocate to every activity of a business its correct proportionate share in receipts and expenditures so that each contemplated change in

[1] See "Waste in Industry." Report of the Committee on Elimination of Waste, of the Federated American Engineering Societies, p. 185.

methods or devices may be evaluated in money units to see whether it will increase income or cut costs. It is this zone of subdivided income and expense to which cost accounting in general has not yet been extended.

On their face such subdivided items may appear trivial. However, since they concern repeated operations in most cases, the annual economy involved is large for any one device or method, and runs up to a very considerable amount when totaled for the whole plant. It may even represent the margin which makes the business profitable.

It is, perhaps, human nature to neglect the small item, particularly if its effect is indirect and hard to trace. There is, however, no excuse for omitting it. Principles and practices should be adopted which will not require too much time and detailed knowledge on the part of the busy executive to be applied to seemingly trivial elements.

Too much stress cannot be laid upon the summarized value of numerous items, individually trivial. American industry has grown to its present proportions through breaking down the complete series of operations performed by master craftsmen into specialized units to which automatic machinery and labor-saving equipment can be applied. Each split-up involves one or more extra handling processes. These intermediate steps cost money, but the aggregate cost of all operations, when efficiently performed, is much less per finished piece than under the industrial system of former days. However, unwise planning of the handling operations, or needlessly expensive methods or apparatus may turn an otherwise profitable system into a losing proposition.

Economy by Efficient Handling Methods

The more highly organized the manufacture of individual parts, subassemblies, and major assemblies become, the greater the number of intermediate steps required, each involving some form of handling; hence the greater becomes the necessity for efficient handling methods. Properly designed and installed handling methods add to the total economy of the process. Improperly devised systems may run the total cost up higher than that under the superseded method. It rarely happens that a manufacturer knowingly adopts a scheme that is obviously more costly than its predecessor. Only acute labor shortage or pressure for rush delivery can ever justify such a course, and then only as a temporary expedient. But managers are many times kept from installing equipment which would cut their costs, because they cherish the false belief that burden charges and consequent total expenses are less under the old plan than under the new. They can readily see that attendance costs, supervision, power, space rental, idle time, interest, depreciation, obsolescence, repairs, office expenses, and other charges should be made against the new equipment, where all the expense items are directly evident. But they fail to realize that hand methods mean enormous proportionate burden which their cost system has never even remotely suggested as charges against the particular processes.

Attendance costs of equipment they are willing to compare with direct labor under hand methods, and to admit a positive saving for this element. Supervision over hand operations, necessary not only on the part of minor executives but also by company officers, is often glossed over by a guess which actually may run to only a tenth of the true value. The facts are usually overlooked that men may require much more operating space than substitute equipment; that the loss on idle time is often huge with hand labor; that a large pay-roll means tie-up of capital and loss of interest; and that the many slips in operation, lack of reliability, and slowness to improve methods where human means are employed far outweigh any possible depreciation, obsolescence and repair charges on mechanical systems. When actual *totals* are compiled from *correct* cost records the superiority of a well-adapted material handling scheme is usually indisputable.

A further important consideration that is very frequently overlooked may be stated in the form of two axioms:

1. A high fixed charge or burden ratio is inevitable with efficient organization and efficient use of labor.
2. A low fixed charge ratio naturally follows inefficient production.

Brief explanation will make the application of these statements apparent. Suppose that if labor were efficient, 100 men would be required on a certain kind of work. Assume that, on account of inefficient handling of labor, 150 men must be employed to do this work, other factors remaining approximately the same. The ratio of burden charges to pay-roll is 50 per cent *greater* under the efficient method than under the inefficient scheme, yet no manufacturer is so unwise as to claim that to reduce his *ratio* of burden he would employ *more* labor and use it inefficiently.

Hence a manager naturally must expect that, on the basis of direct labor involved, his burden *ratio* will be greater with labor-saving equipment than with hand labor. Whether the *total* amount of annual burden in dollars increases or decreases by the substitution usually is of no great importance, because the ratio of burden to final cost of product turned out will show a very marked decrease if the new equipment is well adapted to the job. Moreover, in the long run the total incidental cost or burden will usually increase as the number of workmen increases, and decrease with a decrease in number of workmen.

After a great deal of painstaking study, dating back over a period of several years, a set of formulas for measuring the economy of labor-saving equipment has been developed along lines already explained in the pages of this magazine.[2] These formulas obviously must depend for their application upon information regarding costs under methods which the proposed equipment is to supersede, and they will naturally be

[2] See MANAGEMENT AND ADMINISTRATION, October 1923, pp. 443-444 for complete information. These formulas were developed by a committee of the Materials Handling Division of the American Society of Mechanical Engineers, of which William F. Hunt, Charles H. Newman, and James A. Shepard are the members.

of the greatest use in deciding on the economies of proposed installations. The lack of actual knowledge regarding present costs, and especially true burden, which is a tremendously important factor, means that a manufacturer, in applying the formulas, may, without detailed cost information, use false figures in this connection, and hence badly deceive himself as to the economy of the contemplated change.

To facilitate in this article a further discussion of the formulas beyond that which has already been published, they are reprinted here:

Let:

Debit Items
- A = percentage allowance on investment.
- B = percentage allowance to provide for insurance, taxes, etc.
- C = percentage allowance to provide for upkeep.
- D = percentage allowance to provide for depreciation and obsolescence.
- E = yearly cost of power, supplies, and other items which are consumed, total in dollars.

Credit Items
- S = yearly saving in direct cost of labor, in dollars.
- T = yearly saving in fixed charges, operating charges, or burden, in dollars.
- U = yearly saving or earning through increased production, in dollars.

X = percentage of year during which equipment will be employed.
I = initial cost of mechanical equipment.

Results
- Z = maximum investment in dollars justified by the above consideration.
- Y = yearly cost to maintain mechanical equipment ready for operation.
- V = yearly profit from operation of mechanical equipment.

Then:

1. $Z = \dfrac{(S+T+U-E)X}{A+B+C+D}$
2. $Y = I(A+B+C+D)$
3. $V = [(S+T+U-E)X] - Y$

As applied to material handling, a variation in the formulas covers a calculation of the amount of time which must be saved by a given piece of equipment to cover the cost of its maintenance as part of the manufacturing plant.

Assume the case of an electric hoist mounted on a 16 ft. reach jib crane in position to serve two machine tools. The cost of the hoist and crane installed ready for use is $800, the factor I in the formulas. Considering the type of construction and the thoroughly standardized design of such equipment, the following valuations for the various factors employed in the formulas are probably appropriate.

A = 6 per cent allowance on investment.
B = 4 per cent allowance for taxes, insurance, etc.
C = 5 per cent allowance for upkeep.
D = 7½ per cent allowance for depreciation and obsolescence.
E = Yearly cost of power, supplies, and other items that are consumed per h.p. of motors employed as follows:

Light service	$6
Medium service	$12
Heavy service	$18

For cycle hoisting, as on grab buckets and cargo cranes, it will usually be preferable to make individual calculations of power requirements.

Then: $Y = \$800 \times (6 + 4 + 5 + 7.5) = \$180$.

This is the cost per year to maintain the equipment ready for operation.

Taking an average of one lift every 10 min. and estimating E at $15 per year of 2400 hr., we get $180 + 15 = $195 for the total yearly cost of maintenance, power, supplies, etc.

Two machine operators whose machines are served by the equipment in question are working at an hourly rate of $0.60 and a fixed charge rate of $1.02 each, or $3.24 per hr. for the two. Then $195 ÷ $3.24 = 60 hr., which is the time that must be saved per year to equal the cost of maintaining and driving the hoist. 60 ÷ 2400 = 2.5 per cent, the portion of working time that must be saved in order to justify the expenditure.

A working day of 8 hr. equals 480 min. and 2.5 per cent of this is 12 min., which must be saved from the working time of each of the two men to cover the cost of maintaining and operating the hoist.

A lift every 10 min. means 48 lifts per day or 12 pieces handled to and from each machine daily. Twelve min. to be saved on 12 pieces (two handlings for each) means that one-half minute must be saved by the equipment for each handling in order to justify its cost.

Any saving beyond this, plus the value of increased production from the two machines, will become clear profit.

Briefly stated, the two fundamental principles underlying the formulas are that:

1. Labor saved by mechanical equipment must be credited at the same value as labor used in production under the old scheme.
2. Increased production usually carries a higher value than normal production.

Attention is particularly directed to the fact that T and U are composite factors, and that the values given to them are, for convenience, the totalization of a large number of items often too small to be handled individually. Factor T can never become a fixed value, but will vary according to the nature and method of organization of the individual business. But *always*, S, T, and U must be applied in accordance with the two rules outlined above. The fault in previous practice was that the value calculated for labor saved has been lower than assigned for labor used. Labor saved should carry its full share of former burden in crediting it to the labor-saving equipment.

The value of increased production, U, required in the formulas, is by no means a subject for mere guessing. It has to be worked out in each individual plant, and is a problem strictly up to the cost department. Here again, unless the cost system has adequate subdivisions of accounting, the value calculated may be far to one side or the other of the truth.

The monetary value of increased production will, of course, reach its minimum where an arbitrary and limited production is required, and will rise to a maximum where additional product is demanded and is obtainable either by duplicating units of present equipment and employing additional workmen, or increasing the productivity of units already installed.

It has been stated above, and in the official report of the committee, that the extent of expenditure for items accounted as burden will usually bear some fairly proportional relation to the amount of labor performed, increasing with an increase of labor and vice versa. In applying the formulas, however, it is advisable to determine the actual facts.

Exception to the rule will rarely, if ever, be found in connection with operations which are capable of expansion proportionately as facilities are increased. Where the service to be performed is strictly limited as to quantity or extent, certain items of fixed expense, such as interest, depreciation, fire insurance, maintenance, etc., which are substantially constant, irrespective of the continuance or extent of operations may be covered by separate calculation.

If an *adequate* valuation is placed upon increased production, both actual and potential, where improved processes are installed, the above class of items may be accounted separately under all conditions without affecting the accuracy of the results obtained.

Owing to the difficulty of ascertaining a suitable valuation for increased production, especially during the period while it is potential rather than actual, it is considered preferable to assemble all fixed charges into a single total to be apportioned to each unit of labor by percentage.

The decided convictions we have expressed regarding the value of an adequate cost system reaching down into the details of manufacturing are based on actual experience covering a period of 20 years in developing a thorough and efficient cost department. This department has at all times been the cornerstone of the business, and its accurate work has enabled us to know exactly where we stood at all times, and to determine all financial and operating policies in the light of complete information.

To set at rest any question of the relatively high percentage that burden bears to direct labor cost in an efficiently organized business, the following typical figures, concurrently in use at our plant, are presented. Burden equals:

Manufacturing Costs	170 per cent of machine shop pay-roll
	120 per cent of machine assembling pay-roll
	130 per cent of structural shop pay-roll
	110 per cent of crane assembling pay-roll
	120 per cent of controller assembling pay-roll
	10 per cent of indirect labor pay-roll
Development Costs	100 per cent of toolroom pay-roll
	85 per cent of pattern shop pay-roll
	200 per cent of drafting room pay-roll.

Our system of calculating burden items follows closely the method prescribed by the Electrical Manufacturers Council, which has been approved by the Federal Trade Commission.

The items which are charged to burden are only those which relate directly to manufacturing and do not include interest on invested capital, administrative expenses, or selling expense.

These fixed charges are believed to be conservative for an efficiently organized and conducted manufacturing plant and fairly representative of those found in similar work in any well-organized business. An exchange of figures with two leading structural plants confirms by close agreement the reasonableness of our burden ratio of 130 per cent for this class of work.

Function of the Formulas

The use of the formulas, it is hoped, will open the way in many instances for an accurate determination of the benefits to be obtained by the substitution of improved mechanical methods for hand labor operations. With the facts in hand no manufacturer will hesitate to make his decision, and the builder of such equipment will get full credit for the large savings he is making possible, which is often not the case today.

A valuable function to be fulfilled by the formulas will be that of rendering costs of alternative processes computed by their use not only truly representative of the facts as they have been, or may be expected to be developed, but also to render them truly comparable.

The necessity of a standardized method of accounting in order to produce results of a known composition, and which may therefore properly be compared, has long been evident. With results arrived at by different computations, especially where the various factors may contain overlapping elements, no detailed checking is possible to reconcile conclusions.

There is great need of co-operation among manufacturers in every line of industry to test the economy formulas for labor-saving equipment on contemplated apparatus. It will be especially helpful to determine the *correct* burden ratios prevailing under present methods, together with the other factors involved in the formulas, and record them for comparison later on with the substitute mechanical equipment when it is installed and running smoothly. Only by concerted effort and the willingness to file such data with the technical and trade associations where it can be classified, compiled, and made available for the guidance of managers facing similar problems, can each plant hope to secure for itself the greatest possible economies from the wide variety of improved methods available. Secrecy and isolation belong to the past. The most rapid progress and the greatest individual benefits have always been obtained through the frank exchange of ideas and experience data, and no better plan has yet been proposed for industry in the future.

The Practical Advantages of Mass Management

VI—"The Organization of Modern Industry"*

By DEXTER S. KIMBALL

[illegible]

Index Number
658.16 Organization of industry
658.4 Personnel

THE written history of the race is largely a record of personal achievements. Nearly all great historical movements center around some great figure whose dominating personality, or superior intellect, was responsible, largely, for bringing some great change into being. While the ideas and objectives of these great leaders are well known, the mental processes by which they organized men to do their bidding are largely lost to us. Even the great military leaders whose deeds are the outstanding features of history have left us little recorded knowledge of their methods. It is no wonder, therefore, that the philosophy of organization has, usually, been beclouded or overshadowed by these great figures and that management and organization have so long remained an art rather than a science. Even today in this age of scientific attainment in all other branches of human endeavor, we are prone to associate successful management with some peculiar qualities of personality.

It is true, of course, that personality is the great factor in most enterprises where the human element is concerned, and it is equally true that no machinery of organization can take the place of strong personality. Yet it appears that there are certain basic principles, an observance of which will greatly strengthen personal qualities, and which can be recorded so that succeeding generations can profit by the experience of those who have gone before exactly as in other lines of work. In other words, there is a *science* as well as an *art* of management.

These basic principles are, of course, applicable to all kinds of enterprises but, like the basic economic principles of production that have been discussed in preceding articles, they find their widest application where large numbers of workers are to be managed; or to use a modern expression, where the problems of mass management are to be solved. The recognition of these principles of management has grown, in fact, out of the endeavor to apply these basic economic principles of production through the co-ordinated efforts of large numbers of men. These basic economic principles, such as division of labor, transfer of skill, etc., are impersonal and can be discussed intelligently with little reference to the human side of industry. But it should be remembered that while the general principles of industrial organization and management can also be discussed impersonally the actual application of these principles always touches the human element in industry very closely, and many modifications in theory and adjustments of principles are usually necessary in every actual practical case.

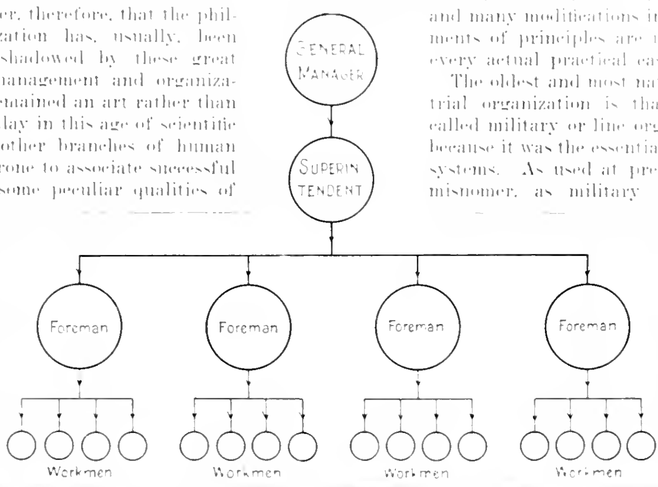


FIG. 40 THE MILITARY OR LINE ORGANIZATION DIAGRAM

The oldest and most natural form of industrial organization is that which is usually called military or line organization; so called because it was the essential feature of military systems. As used at present, this name is a misnomer, as military systems have been greatly modified by the same influences that have affected industrial organization. Such an organization is shown graphically in Fig. 40. It is the natural outgrowth of the necessity forced upon the manager of a growing enterprise to deputize certain duties to subordinate officers. The latter in turn deputize their overload of duties to officials of still lower rank, this general method being followed as the industry grows larger and larger, the basic productive processes of the actual producers remaining practically unchanged. In such an organization the lines of authority run directly from manager to workman and all men on the same authoritative level are entirely independent of all others similarly situated. Each man is responsible only to one man in a superior position and each man in a superior position gives all directions and instructions to those under him. The general range of duties is the same for all men of the same general administrative level. Division of mental and manual labor is, therefore, incidental rather than the result of careful planning and forethought.

It will be clear that under such a form of organization administrative control is very efficient. As the duties and responsibilities of each individual are clearly

* Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION, July 1923, p. 17; August 1923, p. 165; September 1923, p. 333; October 1923, p. 437; November 1923, p. 599.

defined, there can be little misunderstanding as to what these are. It has, however, some serious disadvantages. As enterprises thus organized grow in size the system tends to load the most important executives with a variety of duties that may be beyond their physical and mental capacity. The tendency in such cases is, naturally, toward crude methods and poor work, since few men can do more than a few functions well, particularly if these functions are unlike in character. More important still, it will be obvious that, since division of labor is more or less incidental, under this method of organization expert advice and expert performance are not so readily obtainable as under other methods. The military method of organization has, therefore, been used infrequently in a pure form except where the number of men involved was small or where the scientific basis of the industry was comparatively narrow.

The second principle in organization will be clearly understood by considering an industry where the scientific background involves several lines of work markedly different in character. Thus suppose that chemistry and engineering are important factors in the industry. From the very nature of the case the general manager must depend primarily upon experts in these fields. Hence, the second administrative level (Fig. 41) is made up of three men whose functions are widely different in character—a chemist, an engineer, and a superintendent of production—each supreme in his own field and no one being above another, though all are responsible to the general manager to whom they act singly or collectively in an advisory manner. Furthermore, each foreman of the third administrative level now receives information and instruction from three distinct sources, each source supreme in its own field of effort.

Suppose, furthermore, that instead of assigning a wide range of duties to each foreman, as under the military system, he is charged only with a very few and that he be given supervision of the duties of all workmen that fall within that range. Thus one foreman may attend to all transportation in the factory, another may assign the work, another may superintend all machining operations, another may have charge of inspection, while another may have charge of general discipline in the shop, and so on. Each workman would then be guided by instructions from several men, each one of whom will give him expert guidance in some phase of the work.

Such a form of organization, it will be noted, conveys information and advice to each man through specialists and not through men who have a little knowledge about a great many matters. The separation of mental and manual processes and their subdivision into specific duties is planned with reference to the functions to be performed and not in an incidental manner, or because of personal qualifications. This method of organization is known, therefore, as functional organization, and it is based upon a most important principle. In this method provision is made for the fullest use of the principle of division of labor, each man's functions

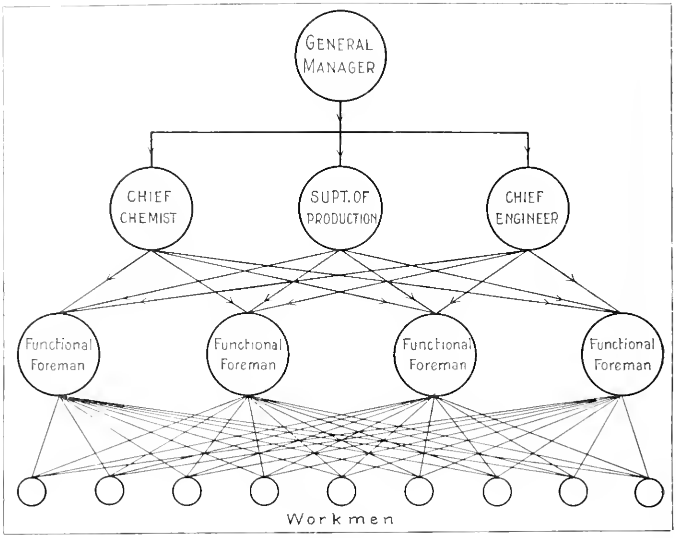


FIG. 41 THE FUNCTIONAL ORGANIZATION DIAGRAM

being kept down to a minimum, and it tends, therefore, to high efficiency on the part of all concerned.

It will be obvious, however, that organizations such as these tend to become unstable so far as executive control is concerned unless special care is taken to co-ordinate the several functions. In fact the successful use of this principle in large organizations depends on the ability of those in administrative control to harmonize and co-ordinate the functionalized activities.

Practically all industrial organizations as found in actual practice are combinations of the two principles that have been discussed. Usually there is a strong backbone of line organization to insure executive control combined with a certain amount of functional organization to insure the necessary special knowledge and guidance. Such combinations of these two principles are called line-and-staff organization. Fig. 42 shows such an organization diagram and may be considered as typical of American industrial organization.

It should be noted that any and all of these schemes of organization spring from the necessity or desire of extending the principle of division of labor which was discussed in the third article[1] of this series. They are all plans for assigning certain duties to certain men so as to secure the benefits of systematic organization that have just been discussed. The simple assignment of duties, however, is not sufficient to secure results. The work of each man must be co-ordinated with that

[1] MANAGEMENT AND ADMINISTRATION, September 1923, p. 333.

of his fellow workers. The problem is analogous to the design of a machine. It is not sufficient to design each part so that it can do the required work; it must also work in harmony with all other parts. It is axiomatic, therefore, that division of labor must always be accompanied by co-ordinative influences. In small enterprises these co-ordinative influences may be provided in the personality and ability of an individual or individuals, but in large undertakings personality is not sufficient and recourse must be had to what has become known as system.

The most important principle in co-ordinative effort is the use of written communications. It is a basic principle in modern management that all directions and instructions as to how work is to be performed and all reports as to how accurately these directions have been carried out must be in documentary form, written, printed, or some combination of these two. This gives definiteness to all transactions and through duplicate copies records of all instructions and reports can be preserved and referred to at will. This feature enables the manager or others who may be interested to trace errors and faults and to place responsibility where it rightly belongs. Documentary control of this kind when properly conceived and operated almost automatically defines the duties and responsibilities of every man in the organization. The basic need of such documentary control lies chiefly in human frailty. Few of us can give orders and directions clearly and fewer of us can hear accurately. Any verbal direction or report that passes through several transmissions, from person to person, almost invariably gains or loses something in the transmission. Written communications are not subject to such variation, especially if ac[illegible] issuer [illegible].

Any [illegible] tion is beyond [illegible] be noted [illegible] or complex [illegible] only two classes [illegible] called orders, and [illegible] instructions [illegible] tions issued from the [illegible] departmental [illegible] who are charged with directing [illegible] work [illegible] purchases, and providing ways and means. The second class may be called returns and includes all documents and reports recording the results of the operations authorized by orders, accounts of materials received, labor expended, tests performed, etc. Orders, in brief, direct how work shall be done, and returns record how it has been performed.

A most important development of the returns that flow upward, so to speak, from the bottom of the administrative diagram is the managerial report. It is difficult if not impossible for the manager to obtain, from the voluminous returns themselves, or from departmental records, a clear idea of what is occurring unless these returns and records are presented to him in the condensed form of reports. Such reports if carefully compiled are far more accurate than any personal observations and they are practically the only way in which the manager can keep a clear vision of what is actually transpiring in the enterprise.

The second important principle in co-ordinative effort is the committee system. The use and reasons for committees may be seen by considering the work of the general manager, the engineer, the superintendent of production, and the chemist in Fig. 41. Many of the

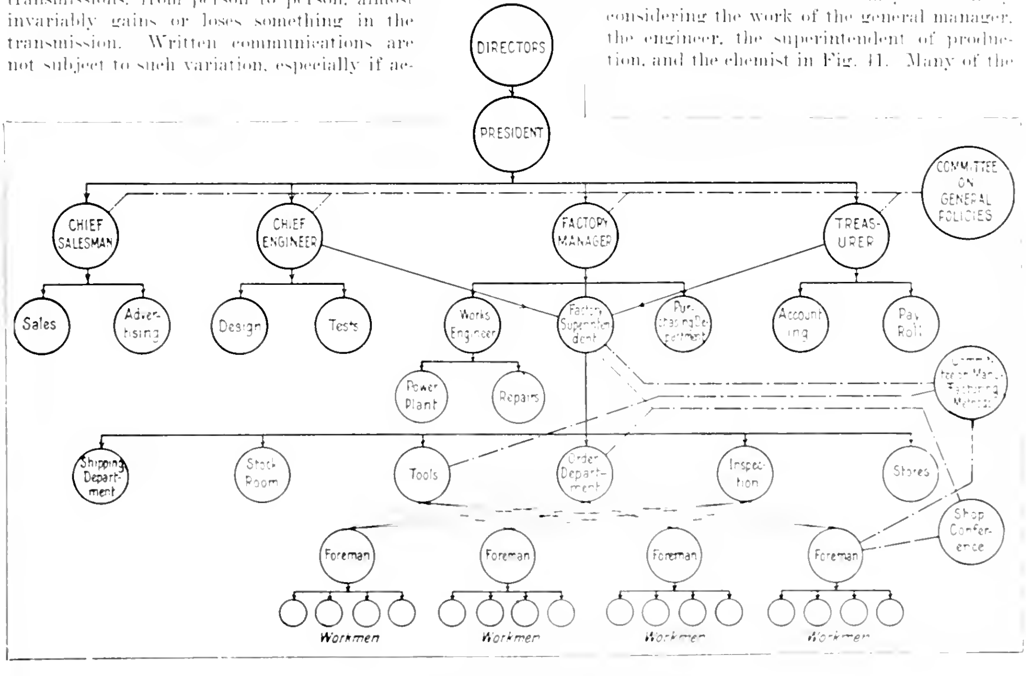


FIG. 42 LINE AND STAFF ORGANIZATION DIAGRAM

problems of management presented to the general manager cannot be solved by him alone because he has not the special knowledge necessary. This special knowledge has been divided and functionalized in the persons of his three chief advisers. No one of these men in turn can advise him intelligently on all the phases of a difficult problem, but when all three are called into joint conference, the problem can be viewed from all angles. A committee, therefore, is a device for gathering together for joint action the functionalized individuals who have been created by division of labor, and its power and usefulness are self-evident. There are several inherent advantages in a good committee. It is impersonal in its action, and its action and its verdict, like those of a jury, are usually based upon the facts presented, and not upon personal opinion or prejudice. Committees also tend to awaken interest in the work and to promote good feeling in the group. It should be carefully noted, however, that committees, by their very nature, are always of an advisory character. They cannot replace personality, but they can greatly assist the busy executive in finding out what should be done, and by recording these findings in carefully prepared reports. The committee system is capable of wide application, but any extended discussion of the character and scope of committees as used in industrial plants is beyond the limits of this paper.

Out of the most important advances that have been made in the field of industrial management in recent years is the extension of the theory and practice of planning operations in advance of their execution. Planning is an instinctive process, but the extended separation of mental and manual processes so characteristic of modern industry has enlarged our horizon as to the possibilities of planning in general. Our ability to plan in advance depends upon our knowledge of correct theory and our recorded experience in the use of this theory. Thus the engineer possessing both of these factors in a large measure can plan large and complex undertakings with assurance that the results will be as he predicts. In medicine, where the complexity and difficulty of the problems are great, the progress in accurate prediction has been slow; and in the field of commerce we have made little progress in predicting the future of such important matters as business cycles.

It should be carefully noted that planning a series of industrial operations in itself may not be a difficult matter. To plan the best or most economical manner of performing a series of operations and to predict the time required for their performance may be most difficult. Such accurate and complete prediction requires recorded experience that can be obtained in general only by observation and measurement. Thus a complex train schedule can be laid out for a railroad, because the time element of the performances of trains is a matter of recorded experience, and it is only when such recorded experiences or industrial data are known that complete prediction of industrial operations can be attempted. As yet we have collected very little of these industrial data, but there are a limited number of enterprises in this country where all work is carefully planned in advance and complete prediction is made of the time required for all operations. The advantage of such complete control over operations is obvious.

The most complete effort to apply the principles that have been discussed in this article was that made by the late F. W. Taylor at the works of the Bethlehem Steel Company[2] Mr. Taylor discarded all inherited ideas as to the duties and functions of foremen and workmen and installed a full functional organization, each functionalized foreman and workman performing only a few duties. He also made a clear-cut division between the mental labor of production and the accompanying manual labor, placing the planning of all work in the hands of specialists, constituting a "planning department" consisting of three men, one of whom laid out the sequence of operations, another made the instruction card which gave full directions as to the performance of the work, and the third man supplied the cost data and similar information necessary to the making of the instruction card. In the shop itself one functional foreman cared for all transportation, one superintended all machining operations, one inspected all the work, one cared for all repairs, and another had general charge of personal conduct and discipline of the workers. The actual workers received instruction and help from all of these functionalized foremen and because of the wide application of division of labor their range of duties was greatly narrowed.

NAME CYCLOPS HANDLE — LEFT 1074 WA PART NO

MATERIAL # 1045 1½" Sq Cut 10" for 2.

500 MFG QUANTITY 1074 WA 9 DRAWING NO

OPER NO	OPERATION	DEPT	MACHINE NO	MACHINE CLASS	TOOL NO	TOOL LOCATION	TIME LIMIT PER PIECE
1	Forge	7	56	HS	1217	H5B	2. min.
2	Anneal	12	—	V7	—	—	3 hrs.
3	Cold Trim	17	92	TC	1217	H5B	.5 min.
4	Mill	10	47	MP	—	—	.3 min
5	Drill	10	71	DIS	3/8	—	.7 min
6	Heat Treat	12	—	H6	—	—	2 hrs
7	Storeroom	2	—	—	—	—	—

MASTER ROUTE CARD DATE 7-14-18 SIGNED P. Brown

Courtesy of Wallace Clark

FIG. 43 SPECIMEN MASTER ROUTE CARD

As might be expected from the general theory of division of labor Mr. Taylor succeeded in greatly increasing the output of the shop. The gain in production was offset, however, by two increases in expenditure. The first was in higher wages, since he found it necessary to offer an incentive for higher production. This principle, which was not original with Mr. Taylor —that increased pay should be given for increased effort—is now quite fully recognized by progressive employers. The second offsetting influence lay in the increased amount of co-ordinative work that was necessary for such a great increase in division of labor. More clerks were necessary and the documentary control was greatly extended as compared with older methods. This, it will be noted, was unavoidable, as it is in strict accord with the general principles that

[2] See "Transactions of the American Society of Mechanical Engineers," Vol. 24.

have been discussed. As a whole, however, the gain more than offset the added expenditures.

Taylor's plan was particularly applicable to metal-working industries. Many of the methods and principles that he advocated are applicable, however, to all industry, and there has grown out of his work a movement variously named as "Scientific Management," "Efficiency Engineering," etc. Some of the work done under these names by advocates of Taylor's method has been noteworthy, but much of it, also, has been notoriously bad and inefficient. Undoubtedly, many of these failures have been due to a lack of understanding of the true relation between division of labor and co-ordinative influences and lack of appreciation that the successful use of these and similar economic principles is limited and controlled by the quantity to be produced. Comparatively few enterprises have adopted Taylor's methods in their entirety for reasons that will be obvious, but many of his methods are in common use in all manner of industry, and his work and writings have given a tremendous impetus to the use of more logical and more scientific methods in management. Industrial engineering, or industrial management as it is sometimes called, is a well-defined field of activity, and much has been done to place the art of management upon a more logical foundation and to lift it from the empirical and rule-of-thumb basis on which it still largely rests.

No OF PIECES 1000 DATE 10-12-23 ORDER No D 4250

NAME 1074 WA — CYCLOPS HANDLE — LEFT

MATERIAL #1045 — 1½" sq Cut 10" for 2.

No	OPERATION	DEPT	MACHINE No	MACHINE CLASS	TOOL	BEGIN	
1	Forge	7	56	HS	H5B 1217	10	6
2	Anneal	12	—	V7	—		19
3	Cold Trim	17	92	TC	1217		20
4	Mill	10	47	MP	—		23
5	Drill	10	71	DIS	3/8		25
6	Heat Treat.	12	—	H6			29
7	Deliver to Storeroom						31

SHOP ORDER

Courtesy of Wallace Clark

FIG. 44 SPECIMEN SHOP ORDER CARD

Perhaps the most interesting and most important contribution made by Taylor was to call attention to the complexity of all ordinary operations and processes, that heretofore had been considered simple and elementary, and to the inefficient manner in which the greater part of handicraft operations are performed. Taylor and those that followed him have shown beyond doubt that precedent and inherited notions have long held all trades and handicraft work in a crystallized state and that the output of most workers, mental or manual, can be increased by the use of better methods and with less effort on the part of the worker. It is not always an easy matter [illegible] to inaugurate these changes and improvements. Frank Gilbreth by making common sense changes in the ancient art of bricklaying found he could increase the ordinary bricklayer's results several fold, and the work of the late H. L. Gantt in applying similar improvements is worthy of careful study by all who are interested in these new methods. All the evidence that has been gathered from the work of these and other pioneers shows that even the most elementary industrial operations are far from being the simple matters that they appear to be, and an analysis of their character will often open up a way to increased production and lowered costs. The reader may test this statement by studying the motion of his fingers and thumb while buttoning slowly a button on his coat. It should also be noted that the procedure of performing this operation is entirely different when done with the left hand than when performed with the right hand.

The systematic investigation of industrial processes with the view of eliminating useless and wasteful motions has become known as motion study. The idea itself is far from new as will appear by a consideration of the preceding article on plant arrangement.[3] It has long been an important consideration in machine-tool design and in a large way is a primary consideration in all economic plant arrangement. Modern motion study is an extension of these considerations to the study, in detail, of the motions of individual workers in an effort to determine the one best and most economical sequence of processes that can be employed to perform a given operation. When such a sequence can be determined it can be defined as a standard performance and prescribed as the method to be followed in future operations.

The measure of economic performance is the time consumed in any given operation. The old adage that "Time is Money" is strictly accurate when applied to industrial work. The idea of measuring the time of industrial operations as a basis of prediction is, therefore, very old. But the term time-study as used today denotes a more refined application of this idea than heretofore employed. The older attempts at recording the time consumed were confined largely to finding the total time required to a given piece of work and the data thus obtained were useful, generally, only for the particular work in hand or for one very similar to it. Mr. Taylor, however, introduced the idea of making time observations of the most minute details of the operations studied even to such small details as the time required to start or stop a machine. His contention, which seems logical, was that many detail operations are common to many jobs and that if the time required to perform these detail operations could be observed with accuracy these observations or unit times could be used to build up, synthetically, accurate predictions on new work on which time studies had not been made. Thus with standardized methods as developed by motion study and with basic data in the form of unit

[3] See MANAGEMENT AND ADMINISTRATION for November 1923, p. 599.

times complete planning of any operation could be conducted and prediction of results with some degree of accuracy could be assumed. These two important ideals have made much progress in recent years and in all probability they are among the improvements advocated by Taylor that will be of lasting significance. Through time study and motion study industrial data can be gathered on which accurate prediction of future

SYMBOL

INSTRUCTION CARD FOR OPERATION

1 SHEETS SHEET No 1	DRAWING No 6 71	MACHINE No PX-2	ORDER No
MATERIAL / CLASS No	PIECES IN LOT	TIME FOR LOT	BONUS

DESCRIPTION OF OPERATION B 6-20 Horn Gear

Mill Horns

ITEM	DETAILED INSTRUCTIONS	FEED	SPEED	ELEMENT TIME PER PIECE	TIME FOR ENTIRE LOT	CONTINUOUS OR RUNNING TIME
1	[illegible]					
2	[illegible]					
3	[illegible]			.07		
4	[illegible]			.07		
5	[illegible]			.06		
6	[illegible]			.05		
7	[illegible]	Hand	76	.25		
8	[illegible]			.05		
9	[illegible]			.08		
10	[illegible]			.05		
11	[illegible]			.25		
12	[illegible]			.05		
13	[illegible]			.08		
14	[illegible]			.05		
15	[illegible]			.25		
16	[illegible]			.05		
17	Turn			.08		
18	Run in Work to Cutter			.05		
19	[illegible]			.25		
20	[illegible]			.05		
21	[illegible]			.11		
22	Loosen and Remove Nut and [illegible] Lay down Wrench			.04		
23	[illegible]			1.99		
24	25% Mach Time			.25		
25	25% Hand Time			.25		
26	Time in Min.			2.49		
27	" " Hrs			.04		
28						
29	Time for the Entire Lot equals 2.49 Mins or					
30	0.04 Hrs. X No of Pieces in Lot, plus 18 Min or .3 Hrs					

WHEN WORK CANNOT BE DONE AS ORDERED MACHINE OR GANG BOSS MUST AT ONCE REPORT TO TIME STUDY DEPARTMENT	MONTH	DAY	YEAR	SIGNED TK
	12	22	20	CHECKED TK

Courtesy of New England Butt Co.

FIG. 45 SPECIMEN INSTRUCTION CARD PREPARED FROM TIME STUDY OPERATIONS

performances may be based. They stand, therefore, in relation to industrial planning, as engineering research does to engineering design; and viewed from this standpoint they are of great importance. Through the use of these methods many basic industrial data have already been collected, but the amount is very small as compared with that necessary to put industrial planning on the same status as engineering prediction.

The foregoing discussion has omitted, for the sake of simplicity, any extended discussion of the problems of management that center around the human element in industry. Yet these are the most important and most difficult of all managerial problems. Under older and simpler industrial methods the worker was, to a larger degree, an independent, self-sustaining, economic unit, since he had access to the ownership of the tools of industry. Modern methods, as has been noted, have greatly changed his status and have made him dependent upon a complex industrial organization in the ownership of which, for the most part, he has no share, and upon the varying conditions of which his happiness or misery depends. This applies in a general way to all industrial workers and the interdependence of the entire industrial group becomes more intense daily.

The recognition of these changed conditions by the public at large is seen in our voluminous and rapidly increasing legal enactments, both state and national, regulating industry in many ways. In the older industrial states these laws are many and in great detail. It is an open question whether we are overregulating industry in this manner.

Within industry a recognition of these changed conditions is seen in the changed way in which the working force is recruited and cared for after being engaged. In most progressive enterprises this work has been segregated from other functions and placed in the charge of a special department known as the Employment or Personnel Department. Personnel work may well be visualized under two heads, namely, economic and humanitarian. Under the first comes such work as finding the sources of labor supply, analyzing the character of the work, hiring the workers and fitting them to the work for which they are best suited, educating them, if necessary, and acting as a bureau of information that will assist the worker to secure best results. In former days, when men could do a wide range of work, an analysis of the work to be performed and of the worker's experience was not important. In these days of specialized industry and of restricted opportunity on the part of the worker, such comparisons are essential if a stable working force is to be maintained. It has been demonstrated that it is a costly matter to discharge a good worker and hire another to take his place. The question of the physical and mental fitness of the worker for the work in hand is a most important one, and not less important is it that the conditions under which men work shall be conducive to health, comfort, and cheerfulness of spirit. The old happy-go-lucky manner of employing men and of placing them in disadvantageous surroundings is rapidly disappearing before more enlightened economic views.

In the writer's opinion the greatest contribution made by the late H. L. Gantt was the establishing of the truth that it pays to instruct workmen, no matter what their experience may have been, if better results and higher earnings are to be obtained. The "promotion of personal effectiveness," as L. P. Alford has called this general movement toward more efficient effort, is a most important field of service.

It will be obvious that the far-reaching changes in industry that have been discussed in these articles have necessarily made great changes in the personal relations of employers and employees. It is no longer possible in large undertakings to maintain the pleasant and mutually helpful personal relations that formerly existed between master and men. At the same time there is a growing feeling that industry was made for man and not man for industry, and that in some way industry should be remodeled so that it will afford a safe and sound basis for human existence. All forward-looking managers and owners recognize that they are, in a large sense, their brothers' keepers, and that they owe a duty to their employees over and above any legal contract as to services that may exist between them. Today, as never before, therefore, intelligent management is making provision for the proper care of the human element entrusted to them; for management is a trust and is so recognized by a large number of owners and managers. It is true that the law of all progressive states requires a minimum of sanitation and accident prevention and compensation of all industries within their control. But that is not enough. If it be possible, the personal interest which the worker formerly felt in the business to which he was attached must be reawakened. The outward evidence that this view is held by many is shown in the steady growth of what was formerly called welfare work. This term has become identified with certain efforts along this line that savor strongly of philanthropy, paternalism, or reform work. Many of these efforts were dismal failures, but out of these experiences has come a truer appreciation of the content of this work which should be that of true service and not of paternalism. Under the name employees' service [illegible] operation [illegible] in some manner [illegible] has been largely [illegible]. The movement [illegible] scribed by law [illegible] more human and more interesting.

It should be noted that [illegible] movements are, they do not in any way [illegible] the greatest question of all, namely, the [illegible] of the proceeds of industry. Yet [illegible] progress has been made so far, at least, as America is concerned. In spite of the many labor disputes that fill the land there is hope that even this difficult problem can be adjusted without the extreme measures advocated by opponents of the present system. Certain it is, however, that no great progress can be made in this direction until workmen learn forbearance and employers take the view that industry is a trust to be administered in the interests of all and not solely as a source of private or corporate profit.

(To be concluded in the January 1924 issue.)

The Editor's Place in the Management

By J. EVANS SMITH

THE industrial editor as a part of the management and a factor in the control of a manufacturing company must not be confused with the usual house organ editor selected with the idea that most anybody in the organization can handle the job. Quite to the contrary the industrial editor should be a graduate of the competitive school of journalism and a specialist in industrial relations.

His job is to correlate the various energies at work in the organization through a forum for the exchange of thought and to build and maintain that intangible asset upon which the good-will of the customer is dependent on the good-will of the employees.

His importance, however, in the control of labor has been overlooked as is evidenced by the caliber of the average shop paper—which is usually gotten out by men whose conception of a plant paper seems to consist principally in an assortment of jokes more or less familiar to all almanac and funny paper readers.

The true industrial editor produces a house organ based on a most careful analysis of plant conditions, one that reflects the policies and ideals of the company; creates right thinking; counteracts radicalism; develops co-operation and promotes thrift, safety, education, and health.

Problems of an Industrial Editor

Let us now take up the problems which the industrial editor masters, and see how he gets results.

The first consideration of any publication is to insure that it will be read. To secure this attention the paper or magazine must be interesting. What will achieve this end the late Lord Northcliffe tells us in a single word. When asked by a reporter what people were most interested in he replied without hesitation "Themselves!"

Index Number
658.448 Plant paper
659.132 House organs

Employees would rather read about themselves, their jobs, or about the general manager smashing his finger with a hammer than the most beautifully worded editorial about Asia. So to be interesting to those whom it is intended to reach the employees' paper must be local and carry as many names as possible.

But besides being interesting the paper must carry a message or messages put across in one of four ways:

1. News. By news is meant an unbiased, unvarnished, plain statement of facts.
2. Illustrations.
3. Rhymes.
4. Editorials.

Before discussing some of these ways or methods in detail it is well to go further with the internal diagnosis:

On the books of most plants is a big intangible something which is worth thousands or perhaps millions of dollars. It is called the good-will of the customer. There is another good-will, the good-will of the employees, which makes the good-will of the customer possible. They are the only two great factors the company has that its competitor cannot buy—the good-will of its customers and the spirit of the organization.

Working for money is not a sufficient incentive in itself to promote good-will, so the human element is injected by the house organ. It is made to serve as a means of extending personality, establishing an acquaintance between the Big Boss and the employee, and providing a medium of communication, not only for messages but for friendly interest and consideration.

Even a pat on the back can be administered through the plant paper and the news about the wife, baby, birthday party, home garden or other incident or event does the rest. When the worker is shown these items in writing his hope is kindled and the desire to accomplish stimulated. By the same means community interests are established and confidence in the square deal fostered.

Right thinking among employees, right thoughts concerning the company, its customers, and the employer himself, may be promoted by means of short articles or illustrations based on economic fundamentals. To illustrate: When it was learned a wage reduction was imminent a year ago in a certain plant the men were prepared for such an eventuality months in advance of putting it into effect. Photographs of a local shop window in which it was shown what a 1919 and a 1921 dollar would buy were reproduced in the plant paper. Articles were used to show the worker how he benefited through readjustment; first, by the greater purchasing power of the dollar; second, through increased employment. At the same time it was pointed out that if wages did not fall the commodities which wage-earners had to buy could not come down.

The articles were impersonal and the reaction was a voluntary proposal from the workers themselves for a readjustment of wages. This was put into effect and good-will was maintained.

In another instance when physical examination of employees was decided upon the men were prepared for it by being shown what it would mean to them and to their families. Because of the universal opposition of unions to physical examination of employees this was a peculiarly delicate subject with which to deal although it was an open shop.

The "selling" campaign began with an account of what the draft revealed—one out of every three unfit for service—and showed that a survey in the schools revealed the same startling condition among children. Then capital was made of the fact that much of this was preventable, and the value of the physical examination, in bringing defects to light, was recognized. There was a rush to see who could be examined first.

Preparing the Men for Changes

The importance of preparing men for changes, whether it effects their pocketbook adversely or not, cannot be emphasized too strongly. Here the services of the industrial editor are essential. An example of what happens when the management fails to prepare men for such changes is to be found in the automobile industry. An Ohio concern announced to its employees without sufficient explanation a fifty-fifty profit-sharing scheme. When put into effect there followed the most serious strike the industry has ever had.

The men, jumping to the conclusion that any number of millions was to be divided equally between the company stockholders and themselves even bought expensive cars on the strength of what they believed was coming to them. When they failed to get the fortune they expected they struck—walked out in spite of the fact that the plan was one of the biggest concessions made to labor in this country. The management had overlooked the important step necessary to such a move—a program of education such as the industrial editor is fitted to project.

Checking radical tendencies is another duty of the industrial editor. This is not as difficult as might be imagined. The editor in matching brains with the soap-box orator or the expounder of radicalism has the advantage of a publication which commands respect.

Important, also, in the estimation of many employers, are measures warranted to impress workers with the security of their employment. The plant paper cannot assure jobs to the workmen. The plans of the management must do that. But the magazine can report to the employees what those plans are. In this connection we must admit that morale is undermined when there is a constant fear of losing the job—of the plant closing down without notice.

To establish a feeling of security in employment may be considered along with the efforts of the plant paper to attract the best workers, to aid in getting the most production by helping the men to become more profitable to themselves, their employer, and to the community, while at the same time helping to keep them on the job. In this regard there is no better or more effective medium than the plant paper for the suppression of vicious and disquieting rumors. Statement of fact discredits the rumor-monger.

Capitalizing Interest in the Job

The industrial editor, realizing that the more a person knows about any given subject the more interest he takes in it, capitalizes this trait to create interest in the job. Since the average worker's vision is limited it requires a stimulant, and this is administered through a story about his job and its importance to the whole. This often awakens a feeling of new responsibility.

Stories dealing with the raw material from which the article is made, the process of its manufacture, its distribution and its use, are always interesting. Accounts of men who have made good in the game permit the worker to see the possibility of promotion ahead, where he can obtain a better position and larger reward.

Thrift is something that has to be propounded with a regularity that may make it boresome. So to get the message across and make it stick, ingenuity is required. In a recent issue of an employees' magazine the portraits of four workers are shown, together with views of their homes. In a few words each tells how he saved the money to buy his home and what his home means to him.

In the same way safety and health may be put over. In one department of a large plant accidents were reduced from an average of 52 a month to none at all for the year ending May 1, last, and the plant paper was given credit for a big share of the accomplishment.

Classification of Industrial Expense Items Including Their Application

Management Data Summary—Number 21

By H. W. MAYNARD

[illegible]

Index Number
657.524 Factory accounting

PROPER classification of expense, based upon a definite and consistent policy, is essential in obtaining correct costs and proper control over manufacturing operations.

The accurate determination of costs necessitates a rather detailed division of the factory into departments, or "burden centers," and the correct assessment against each burden center account of the expense applicable thereto. Certain costs, such as for supplies drawn from stores, can be charged direct against the burden centers, since the departments which consume them are definitely known. Other costs can be apportioned only according to judgment or opinion.

In general, factory expenses may be divided into two groups: (1) Major items, which may be either (a) definitely assessed against departments, or (b) which, from their nature, require individual apportionment; and (2) items which are individually of less magnitude and which may be grouped for distribution with other general charges, and the total prorated according to the best information obtainable. Modern cost accounting lays emphasis on the accurate allocation of the factory expenditures to a considerable number of departments; this is in contrast to the use of a large number of expense accounts for the factory as a whole, which, experience indicates, is less effective in controlling complex manufacturing operations.

There are various methods of applying the charges in practice; in the paragraphs which follow is described a procedure which has been found practical in operation, and useful for purposes of control. Further on, the expense items which are found in most manufacturing plants are listed, with the customary method of applying them.

Major Charges

Fixed Charges. A single charge is made each month for each burden center account to cover the total assessments for taxes, insurance, and depreciation. If interest on investment is applied as a part of the manufacturing cost, it is made a part of this charge. It is generally convenient to include also fixed amounts for electric light and steam heating, thus distributing these items to cost equally throughout the year. Sometimes repairs are included with the fixed charges, particularly in cases where machines are large and repairs, while infrequent, are expensive.

The distribution of these fixed charges is made as follows: the total fixed charges against land and buildings are distributed to the burden centers in proportion to the building area occupied by each (or to the land area for yard spaces). Buildings of a special nature, intended for a particular purpose or kind of manufacture, such as the expensive steam plant, power-house, electrical sub-station, or any particularly expensive manufacturing buildings, and the inexpensive carpenter shop and lumber storage building, are segregated and their charges applied separately. The remaining buildings, in which the various departments are located for reasons of production, convenience or custom, are treated as a whole; an average rate for fixed charges per square foot is calculated, and the assessment against the departments is made uniform at this rate.

Fixed charges against machinery and equipment, consisting of taxes, insurance, depreciation and interest on investment, are applied on the basis of valuation of the several classes of equipment, such as machinery, motors, power-plant equipment, and belting, shafting, and hangers, in the burden centers.

Distribution of Estimated Fixed Charges

The estimated fixed charges for electric light and steam heating are distributed according to the floor area served, with allowance for less or greater heat or light than the average.

A calculation is also made of the estimated values of average current inventories of raw material, work in process, and finished goods in the various departments, and the taxes, insurance, and interest on investment are distributed over these items.

The fixed charge calculations result in a standard monthly journal entry, which debits each department or burden center with a single charge and makes corresponding credits to the general ledger accounts for Interest Charged to Operating, Taxes Accrued, Insurance Prepaid, the several reserve accounts for Depreciation, and (in the cost ledger) to the burden centers for Electric Light and Power and Steam Plant.

If repairs are included with the fixed charges, the total amount is credited to an account for Reserve for Repairs, against which are charged the actual expenses of each accounting period.

The calculation of fixed charges is complex and needs to be carefully and accurately made, but once completed, it remains unchanged until there is a marked change in the conditions on which it was based.

Indirect Labor. This is posted weekly from the distribution of each pay-roll, which assesses against the burden centers their charges for superintendence, subforemen, sweepers, etc. The proper treatment of various items of Indirect Labor is discussed further on.

Supplies. These charges are posted weekly or monthly from the requisitions on the various supply storerooms.

Repairs. Accurate distribution of expense of repairs and construction is important. Considerable economies can often be effected in this work, particularly if a factory is old and the procedure not well systematized. Valuable information is revealed by a cost control. The best procedure involves a suitable record for accumulating the costs of orders. One form is a repair and construction ledger, controlled by an account for Repair and Construction Work in Process. To describe a complete method for this purpose is beyond the scope of this article, but assuming that an adequate system is in force, the cost of the various standing or special orders may be applied as in Table 1:

TABLE 1. DISTRIBUTION OF REPAIRS AND CONSTRUCTION COSTS

Repairs to machinery. Repairs to motors and electric wiring. Repairs to belting, shafting, and hangers. Repairs and maintenance to piping, etc. Maintenance (oiling, tightening belts, etc.) of machinery. Plant improvement expense (moving machinery and similar expense).	Charged against the burden center for which the work is done.
Repairs to the general manufacturing buildings. Upkeep of yards and grounds.	Charged to general mill burden and ultimately included in the distribution of the total of the latter to factory centers.
Renewal of the major part of machine, such as the main frame casting, broken by accident. Complete overhauling and rebuilding a machine, which will materially lengthen its life.	Charged against the Reserve for Depreciation.
New construction, comprising definite additions to plant value.	Charged to the proper asset account.

It will be noticed that repairs to buildings are charged, not to the particular burden center, but to general mill burden. This is on the theory that such expenses should be borne by the active departments as a whole, and that a department on the top floor should not be assessed more because the roof leaks. An exception to this is in repairs to a special building, previously referred to, which needs to be assessed directly.

Electric Power. The total expense (outside and factory charges) for electric power and lights is distributed to departments (after making a standard credit for lighting expense, included among fixed charges) either according to monthly meter readings, or, if these are not available, in proportion to standard percentages determined by a careful survey of the normal horsepower actually drawn by each department when the motors are running full, reduced according to percentages of the average time that each motor is in operation.

Steam. The total cost of making steam, including fixed charges on the steam plant, wages of employees, and expense of coal actually consumed, is distributed to departments (after making a standard credit for heating expense, including among fixed charges) either in proportion to monthly meter readings, or at percentages determined as for electric power.

General Mill Burden. The share of salaries for superintendents, and for employees in production, cost, and other offices, and the fixed charges and other expenses for the general departments, is totaled, and the total distributed monthly to departments, according to predetermined, equitable percentages. Any particular function may have a special apportionment if necessary.

Miscellaneous Charges. Here are grouped the various other items of expense which are not of sufficient magnitude or importance to warrant an individual distribution under classified heads.

Burden Ledger

A practical method of making the charges and credits to the burden center accounts is to maintain a burden ledger, a form for which is given in Fig. 1. There is a page for each burden center, and debits are made in the columns as indicated, the totals of each period being combined in the column T. "Total Burden Charges." In the column marked "Credits" are entered, first, the credits to burden center accounts for earned burden, or liquidated overhead, and the remainder, which constitutes unearned burden, or unliquidated or underabsorbed overhead, is also credited and closed out each month to the proper Profit and Loss account in the general ledger. At the end of each month, each burden center account is closed, no balances remaining on any of the pages. Each sheet is large enough to carry the entries for from three to six months. On the first line are entered in red the estimated expenses, determined as a result of the calculations of the normal burden rates.

Classification of Miscellaneous Expenses

The treatment of various special items is described in the following paragraphs:

Millwright Work. Charged to the center served, under the heading of "Repairs," unless repairs to buildings, in which case the treatment is as previously described.

Small Tools and Their Upkeep. Charged to the different centers, under the heading of "supplies," according to requisitions on tool stores.

Electrical Upkeep. Charged to the center for Electric Power and Lights, under the heading "Repairs." (This expense is not charged to individual centers

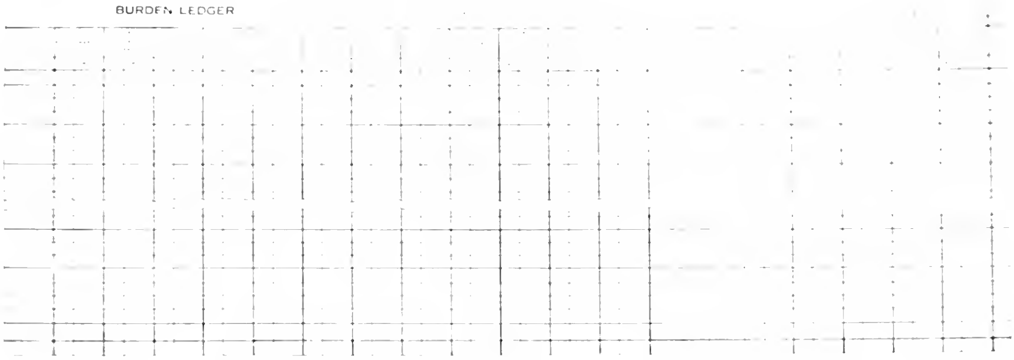


FIG. 1 TYPICAL BURDEN LEDGER FORM FOR THE SEPARATION OF CHARGES INTO APPROPRIATE CLASSIFICATIONS

because the electric cables passing through any department are not necessarily an indication of the power consumed there.)

Oiling of Transmission Machinery. Charged under "Repairs," either to individual centers, or, if general, to "General Mill Burden."

Trucking. Generally distributed between centers for receiving and shipping, according to predetermined percentages. However, if trucking is a large item, normal rates per truck hour may be calculated and at these rates the service in any month is charged to the centers served. The trucking expense is usually included in the rate per pound or quantity for handling material.

Handling of Material (between departments). Sweeping. These expenses are usually included in the Indirect Labor of the departments.

Washing Windows. Cleaning Compounds. Charged to General Mill Burden.

Conditioning. Dust Removal. Ventilation. If for a special center, these items should be charged to it.

Water. Water for drinking purposes is charged to General Mill Burden. If water is used for manufacturing, a distribution is made, according to the best information obtainable, to General Mill Burden and the departments served.

Sanitary Supplies. Medical and Dental Service. If of sufficient importance, charged to a center which may be called "first aid," which is closed each month to General Mill Burden. Otherwise charged against General Mill Burden direct.

Care of Yards and Lawns. Disposal of Rubbish. Charged to General Mill Burden.

Waste. Cloths for Wiping. Rust Preventatives. Charged to General Mill Burden, under "Supplies," except where used by some particular department.

Cafeteria Service. A special center is provided for this, being charged with expenses and credited with the income from meals served, the balance being closed monthly to General Mill Burden, and distributed as part of the latter.

Since it is not easy to determine from the burden ledger for income tax purposes the total actual expenses of each class, it is desirable, for convenience, to pass all expenditures through a set of simple expense accounts in the general ledger. At the end of the year, when the income tax statement is prepared, it is possible to take off the balances of these accounts merely, without making the extensive analysis of the burden ledger which otherwise would be necessary.

Accounting for Special Features

Nearly always a plant will have one or more features, such as the manufacture of shipping boxes or preliminary processes on certain raw materials, which require a special series of accounts for their treatment. Each of these is worked out on its own merits and the expense applied in the most practical manner. It is obvious that no general system of treatment can be arrived at that would cover all special cases arising in the various industries. It is usually desirable to carry such accounts separately, as many of them cover branches of operations on which it is necessary to check up economies occasionally, and have the special work done outside where this method is cheaper.

Selling and Administrative Expenses

It has been the custom to record costs of selling and administration through a simple series of expense accounts, the totals being closed periodically into blanket accounts for Selling Expense and Administrative Expense and these in turn into Profit and Loss.

Recently far more attention has been given to these factors. Selling expense can sometimes be apportioned to different lines of product, a desirable procedure where it can be followed. In addition, it is possible to analyze the cost of selling into: (1) taking orders from old customers, where very little selling effort is required; and (2) securing new business. Normal rates per call made by salesmen have been calculated in some instances, and selling expense liquidated into cost in this manner. In a seasonal business it is at least desirable to apply selling and administrative expense at fixed rates per unit of product, so as to equalize these costs in accordance with orders filled.

A fruitful field is thus opened up for analysis.

An Assignment Stock Record System

By E. G. FIELD

Index Number
658.684 Stock records

STOCK records usually require from one to two clerks for each two hundred operators or from \$500 to \$1300 per year for each hundred employees. They are used principally:

1. To keep a perpetual inventory of each item.
2. To maintain a sufficient supply of each item.

Sometimes other uses are included, such as substitution for a separate pricing record.

Most stock records are used chiefly to assist in maintaining on hand sufficient quantities of each item. Often the stock record is arranged to include assignments (apportionments or appropriations) to various orders, or is used in conjunction with separate assignment records. To meet the desire for a simple effective assignment record, which will also dispense with the stock record, the plan shown in Fig. 1 is illustrated.

The following items have been entered on this card:

1. At inventory time there was an order, dated June 13, with balance of 600 due. At the same time, July 1, there was an actual stock of 900 making a total available of 1500.
2. An old assignment for No. 3892, dated June 10, was continued for 400 and reduced the available stock to 500 making the total now available 1100.
3. A new order No. 6743, dated July 12, was placed for 1000 increasing the amount due on order to 1600 and making the total available read 2100.
4. Another assignment No. 4721, dated July 16, was entered for 700, exceeding the available stock by 200 (which would be posted in red) covered by the total available now 1400.
5. Material on order No. 5309 was received on July 26 by delivery of 400 reducing the amount due on order to 1200 and leaving an available stock of 200 above all assignments.

It is clearly shown that any red figures in the available stock column, such as the 200 on the card, indicate that material must be obtained to fill an assignment. In similar manner any red figure in the total available column signals a failure to plan in advance and usually will require special attention to provide the material necessary.

With this form of record employed, the method of operating is important to complete the control. Issues of material should be made only on signature of the assignment record clerk. The storekeeper holds certain goods, representing money, in trust for the company and should disburse them only on proper authorization.

Usually time will elapse between the assignment of material and the issue. This time can be utilized to good advantage in pricing and extending values and posting the inventory accounts. In some cases this feature of early charges is of importance for prompt billing, and at other times it may be construed as a little premature, depending upon the viewpoint.

A duplicate copy of the stores order may be forwarded to the accounting department when the original is sent to the storekeeper, or the accounting department may wait to price the storekeeper's copy after the material is actually issued. A very good combination is to have the pricing and extensions done along

Part					Material				
Ordered					Assigned			Available	
Refer	Date	Quan.	Rec'd	Due	Refer	Date	Quan.	Stock	Total
#5309	6/13			600	Inv.	7/1		900	1500
					#3892	6/10	400	500	1100
#6743	7/12	1000		1600					2100
					#4721	7/16	700	**200**	1400
#5309	7/26		400	1200				200	

FIG. 1 A SIMPLE STOCK ASSIGNMENT RECORD

with the assignment work and have the assignment record clerk daily advise the accounting department of the individual charges. In this way the stores order is held by the assignment record clerk until time to release, and after the material is issued by the storekeeper the stores order may be checked by the accounting department for prices and extensions and used to prove the charges made.

As a stock record can be checked with a physical inventory by subtracting the quantities on issues not posted, the assignment record may be checked with a physical inventory by adding to the record the quantities on stores orders posted but not filled. Likewise at any time the inventory accounts may be promptly placed in actual agreement with the physical inventory by subtracting in total the material charges for stores orders not issued. This can be done in less time than would be required to finish individual posting of the usual collection of stores issues.

The application of such an assignment record, without any other stock record, is variable enough to meet any conditions and will prove profitable in many ways. The simplicity of operations combined with single posting of full amounts rather than individual issues will decrease the clerical time usually required in handling stock records, and speed up the accounting work, with equivalent time saving in that department.

Establishing Overhead Standards

"Increased Profits Through Control of Costs"—Article Four

By R. W. DARNELL

[illegible], Ritter Dental Manufacturing Company

Index Number
657.524:658 Cost control
657.5241 Overhead costs

> The proper control of overhead is one of the elusive and troublesome problems of productive industry. Mr. Darnell explains the accounting treatment of overhead both in the factory and in the office: the distribution of overhead and the establishment of standard overhead rates; the current checking of actual performance against these standard rates; the adjustment of discrepancies; the make-up of a budget and bonus plan for keeping overhead down in the factory, and, generally, the control of the overhead element of cost.

OVERHEAD is made up of four principal elements of cost, which may be designated as: (1) Indirect labor, often referred to as "nonproductive labor"; (2) factory supplies; (3) scrap; and (4) fixed charges.

Taking up the first of these, indirect labor, it is necessary in order to secure a detailed analysis, to devise a series of standing account numbers to which the various types of jobs, classed as indirect labor, may be charged. These, again, may be split up into as many different accounts as is necessary to get a very close analysis, so that when the indirect labor for any given department is reported by account, it will show in detail what the money has been spent for, and will allow a very close check-up on the foreman himself.

Indirect labor charges are handled very much the same as direct labor, inasmuch as a time ticket is made out for each particular job. A form of such a time ticket is shown in Fig. 15. These labor tickets show the operator's number, the account number to which the work is to be charged, the department for which the work is done, and they include a description of the work itself. The clock numbers are so arranged that the first figure reports the department in which the operator is working, so this would indicate that the man doing the work is from department No. 9, and they are charging his time against department No. 6, which is at fault.

Handling Indirect Labor in the Office

These tickets, when completed at the end of the day, are sent to the pay-roll department where the rate per hour is inserted and the operator's earnings computed. They are then forwarded to the tabulating department, where they are punched and filed according to the department doing the work until such time as all tickets for the month have been received. At that time, these tickets are put through the sorting machine which separates each department's tickets according to account number. Distribution is then made, which lists all the departments in the plant down the left-hand side of the sheet and all of the account numbers across the top. The tickets are then run through the tabulating machine, which indicates the department being run and the account number, and after running the tickets through the machine for the particular account, it will show the number of hours and amount of money spent on that account number in that particular department for the month. The operator then takes these totals off the machine and inserts them on the distribution, and inasmuch as the tabulating machine itself is accumulating the charges to the various accounts, when the cards for the entire department have been run through the machine, the total for all accounts in that department is taken off. All departments are run through the machine in this fashion, and when this is completed the totals for the various account numbers are added on a comptometer and made to agree with the total of the departments which have been indicated on the tabulating machine.

The distribution of all productive labor is then run off by departments and this is entered on the summary sheet of the distribution. A distribution is also run by department for any capital charges which may have been made in the plant during the month.

These three elements of labor when added together for each department should equal the pay-roll of that department. In case of any error this can be checked back immediately and the discrepancy located. From this distribution is obtained the data for the journal entries affecting the factory ledger, which constitute the amount of indirect labor, the productive labor, and the charges to the various capital accounts or fixed asset accounts.

Factory Supplies

The next element of overhead to be discussed at this point is factory supplies. Factory supplies are those items of material which are used throughout the plant but which do not enter directly into the product itself. Emery wheels, cutting oils, small standard tools, such as drills, cutters, reamers, etc., belong to this class as all are necessary to manufacture the product, but, due to the nature of their use, it is practically impossible to charge them directly against the operation on which they are being used.

In plants where a great deal of japanning or enameling is carried on, the actual japan itself runs into quite a lot of money, but although the material is used directly on the product, the quantity used on each part is so difficult to obtain that it is probably better to charge this directly into the overhead and spread this overhead back over the product on the basis of the number of productive hours spent on each operation.

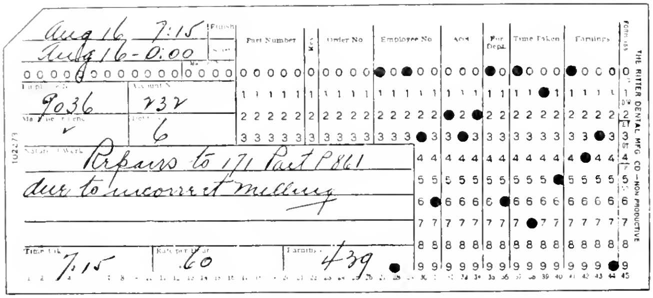


FIG. 15 TIME TICKET SHOWING THE WORK TO BE DONE ON A JOB

In some plants where they are working on the job cost system, they even go so far as to charge small screws and washers, bolts and nuts of inconsequential value, to overhead, rather than go to the trouble and expense of charging these directly against the job. This works out very well when the cost department is building up the costs on the basis of the requisition drawn on stores and charged against these jobs, but the method would likely lead to confusion where costs were being built up on material specifications and where the material requisitions are not charged directly on the jobs in the cost department.

Handling Factory Supplies Through the Records

Supply stores are handled in the stores department very much in the same manner as are the regular productive stores and must be withdrawn on requisition signed by a responsible department head. A form of this factory requisition is shown in Fig. 16. This form is made up on a Hollerith tabulating card and is used as original data in the offices. A perpetual inventory is carried in the stores department and this requisition is used to carry forward the balance of stores on the records.

When the proper entries have been made in the stores department the requisition is sent to the cost department where it is priced and extended and from that point sent to the tabulating department. At the end of the month, when all factory supply requisitions have been priced and extended and passed to the tabulating department, they are run through the sorting machine and sorted out by departments charged. Fig. 16, for instance, shows that department No. 22, which is the millwright department, has drawn 56 ft. of belting, to be used in department No. 34; consequently department No. 34 is charged with this material. After sorting into departments, each department is then sorted by account number, each account representing some specific division of supplies.

Chart of Accounts for Supplies

A chart of accounts should be made up for factory supplies, and given to those who are likely to draw supplies, and they in turn, when making out the requisition, supply the account number to which the material is to be charged. The accounts are made out in such manner as to classify the supplies in a distribution and show what sort of supplies are being used in each department. A few representative account numbers and their descriptions are as follows:

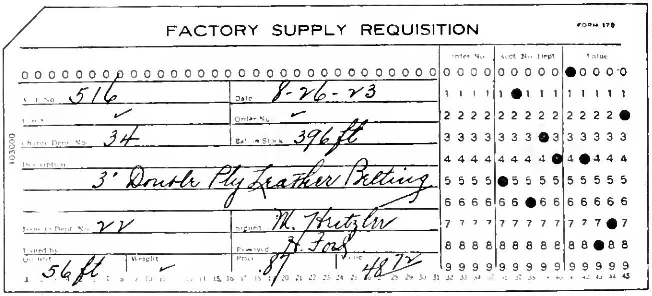


FIG. 16 FACTORY REQUISITION USED AS ORIGINAL DATA IN THE OFFICES

Account 502—To this account will be charged all anodes and other plating and pickling supplies.

Account 506—To this account will be charged buffs for use in making up buffing wheels.

Account 511—To this account will be charged all standard drills.

Account 512—To this account will be charged all electrical supplies.

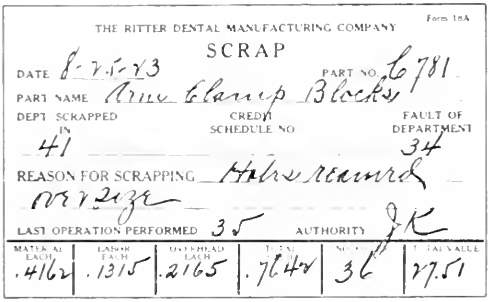
Account 513—To this account will be charged files and file handles.

Account 516—To this account will be charged belts, belt fasteners, belt lacings, and other belting supplies.

By taking off a distribution of supplies by department and account number, it is very easy to tell on examination of the distribution, not only what each department is spending for supplies, but what it is spending it on. This distribution is run off on the tabulating machines and goes from there to the statistical department where it is balanced and journal entries made, from which the various stores accounts are credited and manufacturing expense is charged.

The next element of overhead to be considered is scrap, and by scrap, in this instance, is meant partially completed articles of production which have been spoiled through improper machining or faulty materials. Scrap materials which are left from punch press operations, bar ends on screw machine work, and such like, are taken care of in the material specifications, as explained in the preceding article, and are not considered as scrap.

Some accountants deem a correct scrap report something almost impossible because the foremen and operators hide the scrap or throw the spoiled pieces with the chips, and allow them to be carried out in that way, without any accounting. But, under the method of assigning, as illustrated in the preceding article,[1] the exact number of parts sent out to be completed on an operation is indicated on an assignment ticket and this possibility is done away with. As was stated, the operation is finished, the completed parts on the assignment are returned to the inspection department and thence to the control station. The inspection department does the inspecting and counting, and inasmuch as there are a given number of parts sent out, there should be that many parts returned. If, therefore, there is any shortage, the operator or his foreman is called upon at once for an accounting of the shortage. If he cannot account for it, a scrap ticket such as shown in Fig. 17, is made out to cover the shortage and the number of good parts is indicated on the assignment slip. This provides an absolute check on scrap, and, as stated before, the information secured is vital to the planning department and the factory management for the arranging of their schedule.


Form 18A

THE RITTER DENTAL MANUFACTURING COMPANY

SCRAP

DATE 8-25-23 PART NO. C 781

PART NAME Arm Clamp Blocks

DEPT. SCRAPPED IN	CREDIT SCHEDULE NO.	FAULT OF DEPARTMENT
41		34

REASON FOR SCRAPPING Holes reamed over size

LAST OPERATION PERFORMED 35 AUTHORITY J K

MATERIAL EACH	LABOR EACH	OVERHEAD EACH	TOTAL	NO.	TOTAL VALUE
.4162	.1315	.2165	.7642	36	27.51

FIG. 17. SCRAP TICKET USED TO ACCOUNT FOR SHORTAGE OF PARTS

Getting an account of spoiled pieces does not involve any responsibility on the part of the cost accountant. These scrap tickets are made out by the inspection department which places the responsibility for error. A copy of the scrap ticket then goes to the chief inspector, one to the cost department, and still another to the planning department.

The cost as indicated is arrived at by compiling the labor and overhead cost up to the last operation performed. The material cost in all instances is the [illegible] A [illegible] of the [illegible] ments [illegible] is sent [illegible] manager as [illegible] man [illegible]

The total [illegible] work in process [illegible]

Fixed Charges

Other charges going [illegible] factory has no control [illegible] which come from the [illegible] are made up of depreciation [illegible] into depreciation of buildings [illegible] machinery, depreciation of [illegible] depreciation of sprinkler system [illegible] ber of other divisions depending on [illegible] are kept in the general ledger.

Property tax which is assessed [illegible] county is also another charge [illegible] general insurance, such as fire, and [illegible] ance. Compensation insurance is also determined by the general accounting department, and [illegible] ered as a fixed charge in a way, it varies from month to month according to the factory pay rolls. It is, however, chargeable as a manufacturing overhead item.

Incoming freight and drayage is an element of cost thrown into factory overhead which might be disputed by some accountants, and their grounds for disagreement may be well founded. A charge of this kind depends a great deal on the character of the product which is being turned out and also on the quantities in which the various kinds of materials are used. The matter is one for judgment in each particular case.

These charges are all made from the general accounting department to the factory, and are included in the general factory overhead.

The next step in distributing this overhead over product, is to accumulate and prorate these various elements of expense to the various departments of the plant on the most equitable basis. For this purpose a distribution sheet may be drawn up in the following manner:

On the left hand side in the upper section of the sheet, will be listed the productive departments or, in other words, the departments through which the various articles of product pass for machining and assembling. In the lower half of the sheet will be listed the non-productive departments or service departments, such as the stockrooms, tool crib, sweeping department, trucking department, cost, planning, etc. In the first column is listed the indirect labor which has been charged against each particular department. This does not necessarily mean the amount of money paid to the employees in the particular department, but the charges which have been made against it by various other departments which have done work for it. For instance, if the millwright department does some machine repair work for the drill press depart-

[1] See MANAGEMENT AND ADMINISTRATION for November 1923, p. 605.

[2] *Ibid.*

ment, this time and any materials used are charged directly to the drill press department, and it is a summary of the various charges for indirect labor against these departments which is listed in the first column of the distribution sheet.

Next follows the distribution of supplies charged to the various departments, and following this, the scrap distribution is posted. Then in various columns are a proration of the fixed expense charges against the department. For instance, the depreciation of machinery is prorated to those departments having machinery, on the basis of the cost of the machinery in the department. Depreciation of building is prorated to all departments on the basis of floor space. Compensation insurance is prorated on the basis of payroll, etc., until all charges entering into the total overhead are spread against the various departments in the plant.

At this point the charges against these departments are combined, which gives the total expense against each department for indirect labor, supplies, scrap, and fixed charges. The different elements of expense are totaled for the productive division, as are the elements of expense for the non-productive division. These two, when added together give the total expense by elements. A total of these will then check with the total of expense charged to each department.

Prorating Overhead Against Productive Departments

Inasmuch as overhead is only applied on productive labor or direct labor, and that direct labor is only performed in the productive departments, it is necessary that all factory expense be finally prorated against the productive departments. This, then, would call for another series of prorations by which the non-productive or service departments are spread over the productive departments on the most equitable basis. For instance, the sweeping department would be spread over the productive departments on a basis of floor space. The trucking department will be spread on the basis of productive labor hours, it being assumed that the more productive labor performed, the more handling of stock will be required. Various other methods of prorating the departments will be used until all the expenses have been prorated as accurately as possible to the productive departments. These departments are then totaled, which gives the total amount of factory overhead the productive departments are to bear.

From the distribution of productive labor, the productive hours and productive pay-roll for each of these departments is obtained, and by dividing the manufacturing overhead by the productive hours, the department hourly overhead rate for each department is secured. If it is desirable to know the overhead percentage of these departments, the overhead is divided by the productive labor pay-roll which gives the overhead percentage of each department. These, then, are the rates of overhead prevailing in the individual productive departments during the month, and if an absolute, accurate spread of overhead to the various jobs is desired, in such a manner as completely to absorb the current month's overhead, these rates are used.

But if month by month actual overhead rates are used, it not only slows up the progress of obtaining costs, but it often results in wide fluctuations in the costs themselves. This variation is probably due to the fact that the volume of production is not uniform throughout the plant. In comparing total costs, this discrepancy often results in confusion and may be avoided by the use of standard rates.

Standard Overhead Rates

In order to arrive at a standard overhead rate which may be used for the ensuing year, it is necessary to have a fairly good idea of the expense likely to be incurred in each department during the year. Most managements, especially when they are producing a standard article, can anticipate their probable production for the year and lay out their production schedules accordingly.

In the preceding article [3] of the present series, the method of assembling the machine hour data, or, in other words, the determination of the plant capacity was discussed at length. It may be remembered that from these records was obtained the number of productive operators necessary to produce a given schedule in a given department. Once the schedule has been determined upon by the management, it is not difficult to apply the schedule against the machine hour data, and in that way arrive at the number of productive hours necessary to complete the schedule, and also the productive operators necessary to be employed in the department. Knowing the number of operators required over a given time to produce this schedule, it is not very difficult to arrive at the productive payroll, or the productive hours required in that department for each month. By conference with the factory superintendent and the foreman of each individual department, by investigation of past performances in the department, and by estimating future performances, the expense for each element of overhead can be arrived at very closely for the individual department. Of course, the fixed charges being known, it is no trick at all to determine these charges by departments, and the only items left to be estimated are indirect labor and factory supplies.

When these various estimates have been completed, another overhead distribution is made up similar to the one previously described, using the estimated expenses and the estimated productive hours for each department obtained from the machine hour data record. From this source the estimated or standard rates of overhead for each department are computed and can be used for the ensuing year or other length of time.

The only matter requiring adjustment which arises from the use of standard overhead rates, is that of the absorbed overhead. The amount of this can be readily determined from month to month by taking the actual productive hours expended in each department and extending them by the standard rates of overhead applying to that department. Inasmuch as it is known from month to month what the actual overhead expense is in each department, it is simply a matter of deducting the overhead absorbed, from the actual overhead, in

[3] See MANAGEMENT AND ADMINISTRATION for November 1923, p. 605.

order to obtain the amount either overabsorbed or underabsorbed. A total of the departments gives the total overhead, over- or underabsorbed, for the month.

In a case where overhead is overabsorbed, it indicates that the standard rates of overhead are too high, or rather that they are higher than actual, and that by using these standard rates of overhead in obtaining the cost of the product, the costs themselves are higher than actual. Where the cost of sales is figured from a higher-than-actual cost built up from a standard overhead, they, too, are higher than actual by the amount of the overabsorbed burden in the plant for the month.

To go a step further, when cost of sales which is higher than actual is used in the profit and loss statements for the month, the net profit which results is lower than it should be by the amount of the overabsorbed burden. In such case, to make the profits for the month what they should be, the overabsorbed burden is carried into profit and loss, and the monthly profit increased. If the profit and loss statement is gotten out by lines of product, the amount of overabsorbed burden can be prorated over the cost of sales for each article of the product, according to the amount of overhead contained in each. This, then, spreads the overabsorbed burden accordingly, and makes the cost of each article of product what it should be, and also shows the correct profit figure on each line of product.

In the case of underabsorbed burden, the conditions would be just the reverse, and instead of profits being increased at the end of the month, they would be decreased by the amount of the underabsorbed burden.

Using Overhead Information

To provide for a complete and systematic overhead distribution and labor analysis is useless, unless the information when secured is going to be used to advantage. If the figures were desired only for the profit and loss statement, it would not be necessary to analyze the indirect labor and supplies by account and by department, inasmuch as the total figure is all that is required for this purpose.

It is for purposes of analysis that these elements of overhead are split up in the manner they are, but the usual method of analysis does not mean very much. This is due to the fact that it takes so long to accumulate the information that it is a dead issue when it comes to the attention of the factory management some six weeks or two months after the actual happening. Records compiled in this fashion serve no purpose other than historical data to be used possibly as a basis of estimate at some future date. For this information to be effective and to reduce costs, it must be brought to the attention of those who are directly responsible for the spending of the money.

It is a singular fact in the development of cost accounting that so frequently all cost figures are kept under lock and key as far as the factory itself is concerned. Indeed most managements absolutely refuse to give out cost data of any kind to factory foremen. It is very hard to tell why these methods are pursued, for it seems the height of folly to expect costs to be reduced unless those who are responsible for them have all the facts before them. The manager of a business can sit in his office and pore over factory costs and statistics until he is gray with worry, and can do absolutely nothing towards reducing this expense without the co-operation of the factory executives. They are the men who are spending the money, and who, to a large extent, control it, but they can not be expected to take an interest in costs or methods of reducing costs, if they are left out of all discussion of these matters and are not supplied with data.

Educating the Foreman

Nearly all foremen have gained their positions through years of work in the shop as workmen, and during those years have been subjected to the talk of radicals and walking delegates and others of like status. They have become so steeped in this atmosphere that they can see no side, save that of the workman, and are in sympathy with most of the grievances of labor.

On the other hand, most foremen are proud of their jobs, and if taken into the confidence of the management to the extent of receiving reports on the activities of their departments will develop an intense interest in trying to reduce their expenses or the direct costs of production. Their department is to them what the whole institution is to the manager, and they will take the same pride and interest in it if given the opportunity.

To secure this attitude on the part of foremen is of the greatest importance because they are the only really effective means which management has of reaching labor and of giving the workmen some idea of the management side of industry. If, then, the foremen are not thoroughly sold on the side of management, the loss is real and serious.

It is the author's contention that the foreman should be taken into the confidence of management just as far as is possible, and be taught the fallacy of many of the ideas he had as a workman, and be shown how to combat these things in his own workmen by giving them a broader knowledge of industrial economy.

To do all this the foreman must be made to feel that he is of the management—to feel that he really counts and is part of it. If this is done, through the confidence which nearly every workman has in his foreman, a great deal can be accomplished both for the workmen and for industry as a whole. It is the foreman who should be the messenger of management to labor, for having been a workman himself, and knowing the laboring man's views and feelings, he can win his confidence to a far greater extent than could management by trying to deal direct.

To sum up the matter, there can be no question but that the education of foremen and factory executives is of paramount importance, and that this importance is becoming more and more recognized with the passing of each year. This being the case, in what better way can a foreman be educated than by showing him the records of his department, talking departmental conditions over with him, and pointing out to him, not only where he is wrong, but why he is wrong. Almost any foreman appreciates treatment of this kind and does his best to warrant the confidence which has been placed in him. In practice the author has seen it convince the most radical and socialistic foremen of the error of their views and convert them into excellent executives.

Budgeting Factory Overhead

With all this in mind, it is well to place the overhead expense on a budget basis—at least as to those items which are controlled by the foreman himself. This would mean that indirect labor, supplies, and scrap are included in the budget, but that all fixed charges are omitted. A foreman, as a rule, knows nothing of fixed charges, and as he is not able to effect any reduction in them, their inclusion would, as far as he is concerned, simply mean a confusing complication in the budget figures.

These budget figures should be set up by a budget committee consisting of the cost accountant and factory manager. In setting up the budget figure for each particular department, the departmental foreman and the division superintendent who supervises that department, should be called into the conference.

All figures pertaining to indirect labor, supplies, and scrap should be gone over in detail and set up account by account until all expenditures in the department have been covered. If the foreman is taken into the conference when the budget is established for his department, and has a hand in determining these allowances, he is naturally going to show more interest in them and make more of an effort to reach his goal than if he were not consulted.

Operating the Budget

The budget for each department should be set up in this way and a total budget for the plant arrived at by considering the total of the three elements of indirect labor, supplies, and scrap. In establishing the budget, the figures must be based on a certain volume of production and the variable expense items must be separated from those which do not vary. It is, of course, necessary to revise the budget from time to time as the activities in the factory are increased or decreased or as other conditions change.

Having arrived at the departmental budget figures for a given month, these figures should be divided by the number of working days in the month, thereby arriving at a daily budget figure, which will show each foreman how much money he can spend each day for indirect labor, supplies, and scrap. These figures are then placed on charts showing the days of the month across the top of the chart, and the three elements of expense down the side, with two lines allotted to each element. If the expense, for instance, for indirect labor in a given department is set at $150 a day, the allowance on the second day cumulates to $300; on the third day to $450, and so on through the month until on the last day the figure equals that which was established for the monthly budget.

To go a step further and make this budget figure of real value, actual records of performance are accumulated daily by the departmental timekeeper showing the expenditures for indirect labor and forwarded to the person in the cost department who is keeping the budget. Requisitions for supplies are also forwarded daily to the cost department where they are costed out and totaled by department. The same method is carried out in handling scrap.

With very little work these daily figures of actual performance in the department are placed on the chart in comparison with the budgeted figure, and show at a glance by 2 o'clock on the following day how the individual department stands in relation to its budget. For instance, if on the first day of the month, the department which had been allowed $150 indirect labor, spent $165, an immediate investigation would be made by the foreman and the division superintendent to ascertain what caused it to overrun its budget, and when this information is secured, steps are taken to reduce that expense down to their budgeted figure. The same applies to supplies and scrap.

The Budget Check-Up

These charts should be kept in the factory manager's office and displayed on a rack, and the foremen and division superintendents be required to come in each day and look over their standing in relation to their budget. This plan is very effective as a means of reducing overhead expense, as it shows the foreman and the division superintendent, as well as everyone else interested, exactly the status in each department, each day, and how they stand as to their budget figures. This allows a daily check-up in all departments and an immediate investigation as to why expense is running beyond the budget figure—if it is running beyond.

In practice it will be found that the foreman himself is extremely interested in this budget for he knows that these charts are kept in the factory manager's office and that the factory manager has therefore a direct line on his department and on what he is doing. It is also a source of pride to him, if he can manage his department in such a way as to keep his expense below his budgeted figure, and he will adopt ways and means of keeping expense down that otherwise would never be put into effect.

Paying a Bonus Based on the Budget

The operation of a budget is a measure of economy, inasmuch as the budget itself is usually set at a point below the cost of operating without its aid. If, therefore, the budget figure is maintained, or the actual expense kept below the budget figure, there is a direct and, usually, a material saving in overhead expense.

Anyone operating a department naturally feels that he is operating that department as economically as possible. This is also sometimes true of machine operators who conscientiously believe that they are producing just as much on day work as they would under an incentive plan. The latter, however, usually develops a greater expenditure of energy on the part of the operator than was before thought possible. As this is true, it is simply a matter of good business on the part of the manufacturer to establish an incentive plan in connection with the budget to share its saving with the persons who are effecting that saving.

The best way to do this is to take the plant as a whole and establish a budget figure and pay a bonus on the saving effected. This is better than taking each department individually, due to the fact that there are so many charges back and forth from department to department which might occasion controversy as to where the charges rightfully belonged.

The bonus itself should be paid at the end of the year rather than on a month-to-month basis. This is so because in the operation of a budget plan for factory overhead, where there are so many variables in expense, there are likely to be fluctuations from month to month, and as losses occurring in different departments would not be retroactive those receiving the bonus might be compensated for something which they did not earn. Also a monthly bonus might encourage department heads to withhold expenses which should be properly charged in one month and put them into the succeeding month, or in other words, "juggle" the budget. This is something not likely to happen when the bonus is paid on the yearly basis.

The figures for the budget and actual expense should be computed each month, department by department, showing those departments whose actual expenses are over the budget and those which are under the budget. In this way the weak departments are discovered and an analysis of them will usually show what is necessary to put them on a bonus earning basis.

These figures should be accumulated from month to month and the report as sent out should show both the figures for the current month and those for the year to date. An examination of the budget report shown in Table 1 will disclose pretty clearly the operation of the plan.

In arranging the budget, it is well to group the departments under their division superintendents so that they may be totaled, and show the results of each particular division as well as of the individual departments in that division.

In Table 1 the first division shown is the "Machine Shop Division" and all the departments under the division superintendent of the machine shop are shown. For each department is indicated the budget for the month, and shown directly along side of it, is the actual expense.

Next is shown the budget to date compared with the expense to date for the department. Following this is shown the gain or loss in dollars and cents, first for this month and then to date.

In the next section is shown the percentage of gain or loss, also first for this month and then to date. A total is taken of all productive divisions as well as a sub-total of all service divisions, and then is shown a grand total for the plant as a whole.

The bonus is paid as stated once a year on the per cent which the actual expense is below the budget figure. The head of each individual department shares in the bonus, and each of these department heads

TABLE 1—BUDGET REPORT FOR [illegible]

Divisions	Dept. No.	This Month Budget	This Month Expense	To Date Budget	To Date Expense	Gain or Loss[1] This Month	Gain or Loss[1] To Date	Per cent This Month	Per cent To Date
Machine Shop Division	2	$[illegible]	$5,041.24	$16,740	$17,[illegible]	$12[illegible]	[illegible]	[illegible]	7.48
	3	2,327	1,821.6[illegible]	11,150	10,842.[illegible]	[illegible]	[illegible]	2.[illegible]	2.[illegible]
	4	1,822	1,874.21	8,[illegible]37	8,068.[illegible]				
	5	7[illegible]	601.18	4,75[illegible]	5,0[illegible]	191.82	[illegible]	[illegible]	[illegible]
	6	1,202	1,084.32	6,58[illegible]	6,[illegible]	1[illegible]7.68	[illegible]	[illegible]	[illegible]
	7	1,842	1,906.12	8,43[illegible]	8,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	1,173	916.2[illegible]	[illegible]	6,[illegible]	258.7[illegible]	[illegible]	22.[illegible]	8.11
	9	3,058	2,742.18	12,620	11,728.[illegible]	317.82	[illegible]	10.[illegible]	7.0[illegible]
	14	[illegible]	654.16	3,658	3,462.17	[illegible]	195.[illegible]	[illegible]	[illegible]
	34	2,2[illegible]	1,824.7[illegible]	12,40[illegible]	10,261.[illegible]	111.7[illegible]	2,[illegible]	18.[illegible]	17.24
TOTAL		$18,27[illegible]	$16,26[illegible]	$62,150	$56,330.[illegible]	$1,087.01	$[illegible]	[illegible]	[illegible]
Polish and Grind Division	12	$2,05[illegible]	$1,848.52	$11,152	$10,846.28	$207.48	$665.72	10.0[illegible]	[illegible]
	13	3,462	3,316.28	17,225	16,016.82	150.72	1,206.1[illegible]	4.[illegible]	7.00
TOTAL		$5,[illegible]	$5,164.8[illegible]	$28,677	$26,863.10	$[illegible]8.20	$1,81[illegible]	6.48	6.[illegible]
	19	$1,541	$1,082.40	$9,620	$9,513.62	[illegible]	$[illegible]	[illegible]	1.10
	20	1,810	1,700.38	[illegible]	9,042.57	10[illegible]	448.[illegible]	[illegible]	4.72
	26	10,540	8,876.37	54,287	48,612.49	1,66[illegible]	5,674.5[illegible]	1[illegible]	10.47
	41	8[illegible]	801.67	4,720	4,316.29	[illegible]	403.7[illegible]	[illegible]	8.55
	42	54	26.10	267	308.10	27.84	[illegible]	51.[illegible]	21.44
TOTAL Productive Div.		$38,5[illegible]	$3[illegible],526.77	$199,211	$184,886.20	$1,005.2[illegible]	$14,327.74	10.[illegible]	7.20
Planning Division	16	$1,0[illegible]	$1,041.8[illegible]	$6,802	$6,118.57	$50.17	$683.[illegible]	4.5[illegible]	10.05
	18	1,488	1,564.08	6,901	6,923.08	[illegible]	70[illegible]	5.1[illegible]	1.01
	24	1,0[illegible]	1,161.21	6,182	6,214.2[illegible]	65.[illegible]	[illegible]	[illegible]	[illegible]
	25	2,250	2,306.18	11,874	12,406.1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	30	790	716.18	5,003	4,612.82	73.82	390.18	9.33	7.79
	40	780	721.37	1,226	1,283.29	61.6[illegible]	[illegible]	7.8[illegible]	[illegible]
	49	2,984	2,686.72	11,254	12,412.10	297.28	1,811.84	9.96	12.71
	56	2,642	2,506.54	13,818	12,073.89	135.46	1,744.11	5.[illegible]	12.[illegible]
	58	128	182.12	2,747	2,882.21	[illegible]	[illegible]	[illegible]	[illegible]
	62	288	296.38	3,218	3,182.10	[illegible]	[illegible]	[illegible]	1.11
TOTAL		$13,844	$13,485.62	$72,119	$68,138.3[illegible]	$358.38	$3,979.61	2.58	5.[illegible]
Maintenance Division	22	$117	$92.61	$912	$983.01	$22.39	[illegible]	19.46	[illegible]
	47	6,680	6,720.48	33,148	28,612.91	[illegible]	1,535.1[illegible]	[illegible]	13.68
	48	1,680	1,468.27	11,074	10,172.79	211.73	881.2[illegible]	12.60	7.97
	51	1,862	1,824.36	10,467	9,987.31	37.64	479.6[illegible]	2.02	4.58
	52	84	92.58	522	482.50	[illegible]	39.50	[illegible]	7.56
	53	270	196.22	1,820	1,764.3[illegible]	73.78	55.67	27.[illegible]	3.06
	66	18	16.84	104	116.12	1.16	[illegible]	6.44	[illegible]
	67	494	352.82	2,984	2,622.31	141.18	361.69	28.[illegible]	12.12
TOTAL		$11,203	$10,773.16	$61,011	$54,741.31	$429.84	$6,269.69	3.83	10.27
Other Service Divisions	1	$2,186	$2,064.22	$14,286	$13,212.62	$121.78	$1,073.38	5.57	7.51
	11	1,468	1,424.18	8,344	7,824.19	43.82	519.81	2.98	6.22
	15	3,192	3,102.60	14,940	13,817.68	89.40	1,122.32	2.80	7.51
	17	1,618	1,719.24	8,311	8,416.77	[illegible]	[illegible]	[illegible]	[illegible]
	21	3,390	3,426.08	18,479	17,292.12	[illegible]	1,186.88	[illegible]	6.42
	23	1,258	1,122.17	7,298	7,672.14	135.83	[illegible]	10.70	[illegible]
	28	3,018	2,642.73	18,724	17,292.19	375.27	1,431.81	12.42	7.64
	31	6,164	5,828.82	31,772	28,418.07	335.18	3,353.93	5.44	10.55
	32	4,720	4,519.64	27,872	24,989.70	200.36	2,882.24	4.24	10.34
	33	770	842.60	4,800	4,882.97	[illegible]	[illegible]	[illegible]	[illegible]
	35	390	405.12	2,367	2,064.49	[illegible]	300.51	[illegible]	12.70
	36	1,758	1,628.18	10,488	9,524.70	129.82	963.30	7.38	9.18
	37	1,834	1,802.28	10,943	10,242.5[illegible]	31.72	700.42	1.72	6.40
	38	630	592.63	3,706	3,782.63	37.37	[illegible]	5.92	[illegible]
	43	530	548.09	7,810	7,282.17	18.09	527.8[illegible]	[illegible]	6.75
	44	12,840	11,582.40	57,573	51,849.3[illegible]	1,257.60	5,721.68	9.79	9.93
	46	1,020	982.42	5,840	5,362.98	37.58	478.02	3.68	8.26
	55	10,062	8,946.88	49,071	45,124.68	1,115.12	3,946.32	11.08	8.04
	61	1,490	1,562.18	8,486	8,015.49	[illegible]	470.51	[illegible]	5.54
	63	12	11.40	72	70.00	0.60	1.94	0.50	2.69
	64	2,118	2,064.67	12,428	10,782.16	53.27	1,645.84	2.51	13.24
	65	87	82.12	510	472.08	2.88	37.92	3.38	7.43
TOTAL SERVICE DIVISION		$85,612	$81,159.47	$457,24[illegible]	$428,271.51	$4,452.53	$28,973.49	5.20	6.33
GRAND TOTAL		$124,144	$115,686.22	$656,45[illegible]	$606,857.77	$8,457.78	$49,601.23	6.81	7.55

[1]Italic figures indicate Loss

receives a per cent of his yearly salary, equivalent to the per cent which the actual expenses for the plant are below the budget.

Referring to the illustration again; the per cent saved for the month is 6.81 per cent, but the per cent saved to date is 7.55 per cent, and it is necessary for the department heads to maintain the per cent shown to date in order to draw a bonus at the end of the year. If, as in the illustration, the per cent gained at the end of the year is 7.55 per cent, each foreman participating in the bonus would receive 7.55 per cent of his yearly salary, or, in other words, if an individual foreman is receiving $2000 a year salary, he would receive a bonus check of $151.

The question may perhaps be asked: "Where does the company come in on this bonus arrangement, when the total percentage of expenses saved is paid out?" In answering this it must be remembered that the budget is made up of all indirect labor, supplies, and scrap, and when it is found that the salaries of those participating in the budget are but approximately 25 per cent of the total budget figure the saving to the company obviously is considerable. In fact, the company is actually paying but 25 per cent of the savings.

The method by which the budget is carried along from day to day in chart form in each department, and the manner in which each department head can check up his expenses at the end of the month have already been explained. To assist in this check-up a report is sent to each individual foreman at the end of the month with copies to each division superintendent showing the amount spent on each account number, and in this way the foreman and his superintendent can determine exactly where they have gained or lost on their budget.

A general meeting is held once a month at which all departmental foremen and division superintendents are present, and a large reproduction of the budget report, shown in Table 1, is hung on the wall for their observation. This report is then analyzed in more or less detail by the factory accountant and any alarming tendencies in the various divisions are brought to light and given over to discussion. Those present are privileged to make any criticisms or suggestions about the budget that occur to them. Those departments having large losses are required to explain them, and likewise, those which show large gains on their budget are asked to explain the methods they have used in effecting these reductions. All-in-all, it creates a co-operative spirit among the department heads and division superintendents, for they are all working towards one common end—to reduce the total actual expense.

Drilling for Fires at Out-of-the-Way Points

Index Number
658.284 Fire protection

A FIRE system of drills is not of much use unless it accustoms men to put out fires at points which are least accessible throughout the works, and therefore would give the greatest trouble in a real conflagration. A factory fire force which knows how to reach such points promptly and effectively, and is trained by repeated drills to cope with fires in such difficult locations, can easily handle outbreaks at all places in the plant.

With this thought in mind, a Connecticut factory at frequent intervals stages fire drills which call for putting out a theoretical fire in a covered transportation bridge at a height of 80 ft. from the ground and joining two buildings of the plant.

This bridge is so long that a fire in the middle of it could not be successfully fought from the building at either end, but must be reached from the yard. An aerial ladder has been provided which is long enough to reach the bridge 80 ft. above.

Timing the Drills

The ladder, however, would be of little value if the factory employees were not accustomed to mounting it, carrying up the heavy lines of hose. Every drill is observed by a timer with a stop-watch, and the time of erecting the ladder, reaching the site of the fire and throwing out a smoke pot is carefully recorded. Successive drills are directed toward cutting down the time record.

This method arouses a spirit of competition among the factory fire fighters. They take pride in perfecting their skill and in learning how to coordinate their efforts with those of other men. By means of these drills the fire fighting force has been brought to a high state of effectiveness and is prepared to get the jump on a real fire if one should ever occur.

FIG. 1 FIRE DRILL ON A BRIDGE 80 FT. HIGH

A New Barometer of Industry

By CARL SNYDER

Author of "American Railway Transportation"

Index Number
38(001) Trade Statistics
338.97 Business Cycles

It is a popular and widespread belief that what, in our popular love of phrases, we call "psychological factors" — in plain words, sentiment and moods — what some of our more eloquent writers describe as factors of "mass psychology," play a potent rôle in the determination of business activity.

It has long been the belief of the writer that all this is largely a myth, and that the potent factors in determining the actions of merchant or manufacturer are the actual run of orders and sales; and that the rest of "psychology" is largely negligible. A new index of the volume of trade[1] which we have developed in the last year seems to offer a rather decisive test of these two sets of ideas.

This new index of trade undertakes, from a wide sampling in almost every field of industrial and business activity, to measure the degree of this activity, month by month in terms of percentages of the computed normal rate of growth in each line.

For example, over the last 70 or 80 years the production of bituminous coal, taken, say, in five-year periods, has grown at an astonishingly even rate, averaging a little over 5 per cent per annum in the earlier period and a little less than 5 per cent per annum in the last quarter of a century. In other words, like the population growth of the country itself, the production of bituminous coal shows a regularly decrescent rate of growth: that is, plotted on a log chart, it describes a parabolic curve.

[1] This index is the work of the Reports Department of the Federal Reserve Bank of New York.

What is true of coal production is equally true for practically every other industry or form of business activity for which we have a continuous and extended record, as, for example, railway freight traffic in ton-miles, or postal receipts over the last 70 years, or pig iron production in the same period, and a score or more of others. Though the rate of growth, like, for example, that of the rural and urban population of the country, differs from industry to industry, the characteristic decrescent or parabolic curve is practically true of all.

The "Normal Rate of Growth"

Such uniform evidence seems to bear out what might be a theoretical presupposition in this regard, viz., that as the population of the country grows very evenly from decade to decade but always at a slightly lessened rate, so does the demand for and production of the great commodities, and the means by which they are moved about; that as invention, discovery, and efficient production cheapen the relative cost of these commodities, their use per unit of population likewise grows, and again very evenly; and finally that, just as in the last half century or so the urban population has grown about four or five times as fast as the rural population, so the movement of commodities from the fields, the factories, and the mines has grown at a considerably higher rate than the total population.

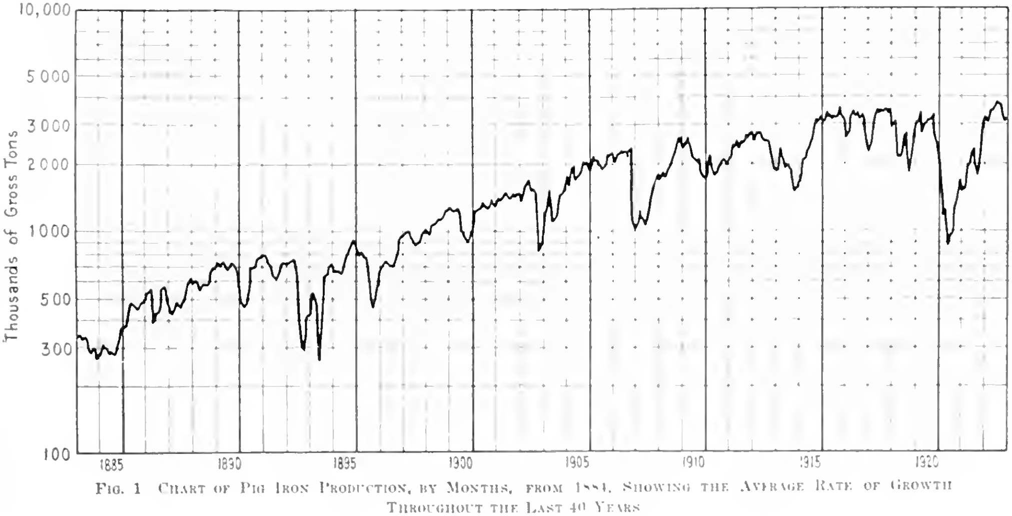


FIG. 1 CHART OF PIG IRON PRODUCTION, BY MONTHS, FROM 1884, SHOWING THE AVERAGE RATE OF GROWTH THROUGHOUT THE LAST 40 YEARS

Everywhere we find the same significant factor of a steady and characteristic or "normal rate of growth" for almost every industry, when taken over a sufficient period.

But while some of these economic activities, as, for example, postal receipts and, let us say, the consumption of such foods as potatoes or wheat, show amazingly little change from one year to the next, other industries have much greater ups-and-downs. Our old friend, pig iron production, is an excellent, and the best-known, example. Long popularly accepted as a reliable "barometer" of trade, we now know that it is neither reliable nor a "barometer" (in the sense that it in any way anticipates other trade movements). It is always a laggard, being one of the last to fall at the end of a boom and one of the latest to resume after a depression. But in spite of its wide ups-and-downs and sluggish action it still has a very even and characteristic rate of growth, taken over a sufficient period, as in Fig. 1.

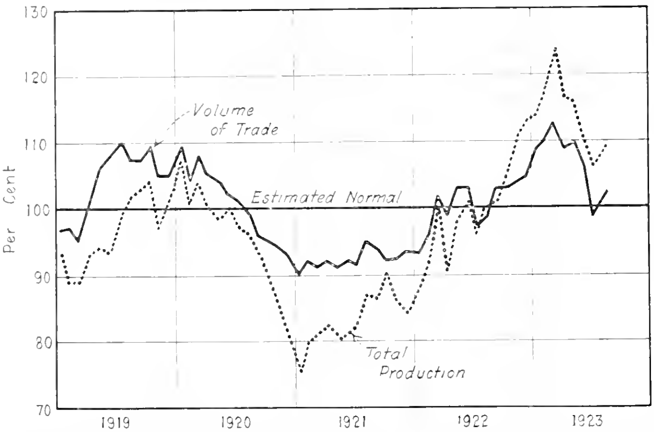


FIG. 2 THE COMPUTED VOLUME OF TRADE COMPARED WITH THE TOTAL OF PRODUCTIVE ACTIVITY, INCLUDING IN THE LATTER BUILDING CONSTRUCTION, AS WELL AS MINE AND FACTORY PRODUCTION

Normal Expectancy

Now, if each industry has this characteristic, normal rate of growth, this establishes for any given year or month a normal *expectancy*. That is, if we take this average rate of growth over the last 40 years and prolong the line into 1923, we find that the normal expectancy of pig iron for this year would be about 37 million tons. But the actual production will run somewhat above this—to over 40 million tons. In other words, it will be about 10 per cent above "normal." In 1921 there was a very heavy slump, and production for the year was not much over 50 per cent of this normal expectancy.

In just the same way we may compute for each year or month the normal growth of all the rest; and then compare the actual product with the average expectancy, and obtain a percentage. This we have done for 15 different products of the pig iron type, which are usually classed as what are known as producers' goods, and the weighted average of these 15 sub-series makes up the index of production of producers' goods in our new index of the volume of trade.

In just the same way the production of 15 other commodities of the type of meat, flour, sugar, tobacco, anthracite coal, boots and shoes, paper, gasoline, etc., are grouped together to form the index of production of consumers' goods. And so on through all the material available as to employment, railway traffic, wholesale and retail trade, building, exports and imports, bank clearings, postal receipts, electric power production, speculation, and other forms of business activity.

In all, 28 such series have been computed and weighted according to the relative importance, and also the estimated reliability of the data as to each. The series, with the weights for each, classed into five different groups, are given below.

It is the weighted summation of these 28 series, each one a percentage of the computed normal for each month (the usual seasonal changes for each being computed where possible) which makes up the final or composite figure for the Total Volume of Trade.

I have been at length to describe the composition of this index, for it is the first attempt to include all of the data available, by months, covering all the larger branches of our industrial activity. It is true that it does not cover the activities of a very great

Productive Activity	*Weight Per Cent*		*Weight Per Cent*
1 Consumers' goods	8	4 Motor cars and trucks	2
2 Producers' goods	9	5 Building construction	4
3 Factory employment	6		
			29
Primary Distribution			
6 Mdse. car loadings	5	10 Imports	2
7 Other car loadings	2	11 Panama Canal traffic	1
8 Wholesale trade	8	12 Grain exports	1
9 Exports	3		
			22
Distribution to Consumers			
13 Department store sales	8	17 New life insurance	2
14 Chain store sales	3	18 Amusement receipts	2
15 Chain grocery sales	6	19 Advertising	2
16 Mail order sales	3		
			26
General Business Activity			
20 Outside debits	8	23 Communication	1
21 New York City debits	5	24 Elec. power production	2
22 Postal receipts	1		
			17
Financial Activity			
25 Shares sold on New York Stock Exchange			2
26 New corporate financing			2
27 Grain future sales in Chicago			1
28 Cotton future sales in New York and New Orleans			1
			6 100

part of the population, comprising almost all the farm population and all that vast body of people engaged in some form of professional, domestic, or governmental service or in the smaller and unreported fields of manufacturing and distribution. This may make up 30 or 40 per cent, or more, of the total, and we know definitely that these activities vary far less from year to year than those for which we have actual monthly data. To this extent, then, our index is not fully representative, and undoubtedly exaggerates the changes from boom to depression. But it is none the less probable that, if we had complete or astronomical knowledge of the whole, the time and duration of these changes would be the same as for the index which we have. In absolute terms, the total industrial or economic activity of the country may vary not more than 5 per cent above or below the computed normal line of growth, instead of the 10 per cent above and below as here shown; but the shape of the line would be the same.

If, then, this new index has been correctly computed (and it has had much expert scrutiny and criticism) we have for the first time a reliable monthly index of the actual volume of trade, or, as we say, "business activity," with which to compare individual fields of activity for which data may be available. Possessing this basis we may test out current theories of business movements.

The first fact which stands out in such a comparison is that when we group the 28 series into the major fields of production, wholesale distribution and distribution to consumers, and general and financial activity, the group which varies from year to year the least, which shows the smallest swings from prosperity to depression, is, precisely as we should expect, the sales of goods to the final consumer. For this index we have an excellent sampling of department store sales, the actual sales of over 15,000 chain stores of various types scattered all over the country, the large mail order houses, the actual excise receipts to the government for all forms of amusement, and so on. It is believed that this composite affords a really reliable index of the retail trade of the country.

Now when we compare this retail distribution with the group comprising various forms of wholesale distribution, and again with the group representing the various forms of productive activity, we find, again, that the variations in wholesale trade are much wider than those in retail trade, and that production varies much more widely than wholesale trade. Which comes first? The facts are set forth in the accompanying Figs. 2, 3 and 4.

It will be seen that any general decline or recovery in retail distribution generally precedes the decline or recovery in production, and, in turn, that in the group representing production the output of consumers' goods, things to eat and wear and use directly, precedes the fall or revival of producers' goods like steel and coal and copper and similar items (Fig. 2).

What seems clear from these pictures is that when the demand arises a revival of production follows, and, vice versa; that it is the final consumer who makes the demand, and that it is the variations in this demand which determine the course of business activity. What are the factors entering into and determining this consumers' demand might well be the subject of an interesting inquiry, since it has been the topic of endless theorizing. All that I am concerned with here is the fact that when the consumers' demand grows strong a revival in trade takes place, and when this consumers' demand falls off a decline begins. Thus, for example, it is clear from the accompanying Fig. 3 that in the five years under view the earlier peak of retail trade was reached in the fall of 1919, and while there was a short-lived peak of wholesale distribution prior to that, retail trade was declining into and through 1920, while wholesale trade kept up for a time.

Again, we have the same picture in comparing retail trade and the production of consumers' goods. Here production follows more closely upon retail trade than does wholesale distribution of all kinds of products; while production of producers' goods follows distinctly later. The relation is illustrated in Fig. 4.

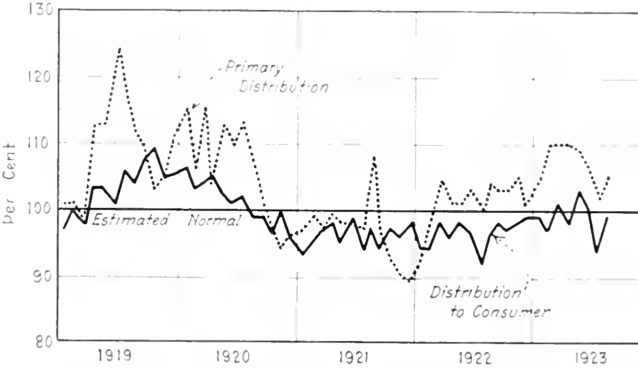


FIG. 3 THE TOTAL OF PRIMARY DISTRIBUTION, INCLUDING CAR LOADINGS, WHOLESALE TRADE, ETC., COMPARED WITH THE COMPUTED DISTRIBUTION OF GOODS DIRECTLY TO THE CONSUMER IN DEPARTMENT STORES, CHAIN STORES, AND THE LIKE

And, conversely, the decline in retail trade was arrested, in 1921, long before wholesale trade, or general production, and production of consumers' goods considerably before that of producers' goods.

Now, of course, we cannot be sure that the movements of these four years afford a picture of an invariable sequence. Indeed, there is high probability that they do not. The business cycle is scarcely the fixed and unchanging thing it has sometimes been supposed to be. But, on the other hand, there was nothing very abnormal in the course of business in this period except, indeed, the extraordinarily heavy rise and fall in prices; and we are probably safe in assuming that the picture we have is fairly characteristic; certainly it would not err on the side of overcompression, but rather towards exaggeration of the extremes.

One fact that stands out very interestingly is that our figures for employment are, clearly, pretty much figures for "factory" employment; and that the index for this factory employment coincides more closely with the index of production in producers' goods than with any other. The inference seems to be unmistakable that these figures are not representative of employment generally; and that, for example, the hysterical estimates which were put out in the depression of 1921, of "five or six million unemployed" were gross exaggerations and represented largely merely the number of men dropped from the pay-rolls of the larger mines and factories, chiefly concerned in the production of producers' goods.

Another fact that engages the eye is that retail trade and the general volume of all trade from the fall of 1919 was declining in spite of the rapid rise of prices which was then under way, and which, indeed, continued for another eight or ten months after the crest of retail and general business had been passed. One inference from this would appear to be that this great rise of prices was not due to an actual demand for goods by the mass of the consuming public, but rather to a clamorous speculation that set in with the great expansion of bank credits which took place in just that period.

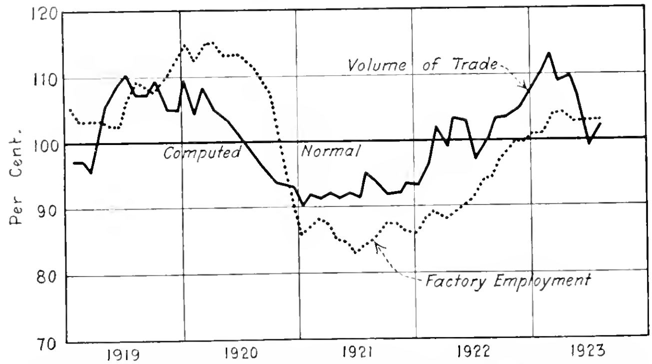


FIG. 4 CHART COMPARING THE COMPUTED VOLUME OF TRADE WITH THE NUMBERS EMPLOYED IN NEW YORK STATE FACTORIES, INDICATING THAT FACTORY EMPLOYMENT IS NOT A CLOSE INDEX OF ACTUAL BUSINESS CONDITIONS

It seems clear, also, that the course of commodity prices, and especially of these prices at wholesale, is not in itself a very good index either of the temper or trend of actual trade conditions. Clearly this was true in the 1919-1920 boom; and it seems equally true in the depression that followed. Both retail trade and general business, according to the computations here made, reached their lowest point in January of 1921, as pointed out. But commodity prices went on falling until the following July or August. Apparently business was well back to normal before any considerable recovery in prices had taken place.

We now come to a still more disturbing suggestion. Of all the psychological moments of momentum, most firmly established would appear to be the idea that the stock market invariably "forecasts" the movements of business; that the clever speculators in Wall Street, with their noses in the air, catch the first faint scents of coming danger or coming recovery, and act accordingly; and therefore that stocks always rise and fall long before the plodding dullards in business are able to discover any change. Certainly in the last five years it would appear from this investigation that this is scarcely the fact. The best barometer of stock prices we have is the new weighted index compiled by the Standard Statistics Company; and this index reached its peak in November of 1919. But the volume of trade apparently was at peak three or four months before.

Similarly the stock market reached its low level in August of 1921, but the recovery in business activity had then been under way for a full six months. In these two crucial instances, and the only ones for which we have full and authentic information, the stock market was far from displaying any foreknowledge or foresight, and belatedly registered an established fact.

It is true that in the very sharp expansion which followed, stock prices reached their peak in the third week of the same month, marking the peak of business activity for the present year, and two weeks before the sharp downturn in commodity prices which began in the first week of April. In this instance the peaks of production, general business activity, commodity prices and stock prices all came together, and so also did the sharp arrest of the slump which followed come all together for all four factors, in July. At the present writing it seems too early to determine whether this sharp slump was the beginning of a long downward cyclical swing or, what it otherwise clearly was, a sharp but brief spasm of overproduction of goods and overexpansion, very quickly arrested.

General Business Sentiment Lacks Anticipation

If it be true that the stock market in general merely follows business, and anticipates little, it would in this regard differ but slightly from the general run of business sentiment. There is an old adage that good times are always ahead of us or behind; they are never here. The writer very well remembers that in the depression of 1921, having rashly made prediction of a rapid recovery, he endeavored in the spring of the next year to prove that this had been verified; but there were few believers. Our index of trade actually shows business back about to normal in March of that year; but it was precisely at that point when pessimism seemed to be of the deepest indigo and there were few to believe that any marked recovery had taken, or even could take place.

The new index and the investigation here recounted are but a beginning. It will be of interest to discover what further disclosures the index will make as it is perfected and extended. The effort to develop a reasonably safe guide for business enterprises answers a demand that is being felt with increasing insistence from producers and manufacturers for information by which to direct future operations.

Recognition of Long-Time Service

A Method Used by the Brown & Sharpe Mfg. Co. to Maintain a Stable Working Force

By LUTHER D. BURLINGAME

Industrial Superintendent, Brown & Sharpe Mfg. Co.

THE value of long service has been more fully appreciated since figures showing the loss resulting from excessive turnover have been made public. This has led to a study of means to insure the maintenance of a stable force of employees.

Prominent among the means suggested is the cultivation, through personal contact, of a good understanding between employer and employee, and the bringing about and maintaining of friendly and cordial relations. This article describes the working out of a plan having this end in view. It is applicable in either a large or small plant.

For many years it has been a practice at the works of the Brown & Sharpe Mfg. Co. to report to the officials of the company when an employee passes the mark of 25 years' service, thus giving an opportunity for personal recognition and for expressions of appreciation and felicitation. Similar reports are also made for those completing longer periods of service, such as 30, 40 and 50 years. More recently, an "Employees' Long Service Record" has been placed in the office hall. It is in the form of a carved oak frame (Fig. 1) and contains the names of all who have been 25 years or more in service with the company, grouped in periods of employment as indicated above.

FIG. 1 EMPLOYEES' LONG SERVICE RECORD CONTAINING THE NAMES OF ALL WHO HAVE BEEN TWENTY FIVE YEARS OR MORE IN THE SERVICE OF THE BROWN & SHARPE MANUFACTURING COMPANY.

This record board has five glass panels secured in place by cam locks turned by a key in the square sockets seen at the top above each panel. Each pane of glass is enclosed in a narrow frame or rim and when unlocked can be lifted in a groove back of the upper lip of the frame sufficiently high to clear the lower lip so that the panel can be removed leaving the names of that section exposed for the purpose of changing them as required.

Index Number
658.416 Recognition of long service

Each name is on a separate strip of buff-tinted cardboard 7/16 in. wide, and the entries are made by using Dennison's 1/4 in. gummed letters and figures. The ends of the strips on which the names are entered slip back of thin brass vertical guides and the cardboard strips are of such a length that they can be bent and sprung in place back of these guides so as to give a hold of 1/8 in. on each end (Fig. 2). Convenience in adjustment is important as frequent shifting is required to keep the record up to date and the entries in order.

To show how workmen feel about this record, one of the men near the head of the 40-year group was much disturbed because his name was below that of an employee who had not entered until after he had. The office records showed that the first man had left at one time, being off the pay-roll for about ten months. This record did not satisfy him, however, and he went to a good deal of trouble to show that when he was away it was because arrangements had been made by Brown & Sharpe to have him transferred temporarily to a factory using many of the company's machines, for the purpose of seeing that they were used to the best advantage, and that he had returned to the home shop as soon as this work was completed. It was considered that his point was well taken and his classification was changed to credit him with continuous service from the earlier date.

The names of officials of the company take their

FIG. 2 METHOD OF CHANGING NAMES ON EMPLOYEES' LONG SERVICE RECORD TABLET

visitors who come into the office or the works.

This being the case, and the record board being in evidence to the men only occasionally if at all, it was decided to provide further recognition in the form of a gold "Long Service Pin." (Fig. 3) an emblem which each can possess and wear either at the shop or when in his "Sunday best."

These emblems are all of the same design for the different groups, but the length of service is stamped on each and different colored enamels indicate the different lengths of service. This color is used as a background for the center of each pin, the outer circle, with the company's name in gold, being white in all cases.

place on the record tablet in order with those of employees in the humblest positions, precedence being determined solely by length of service.

When this record was first put in place it contained the names of 234 employees. This number has since increased to 272, after removing the names of those who have left or died. The total service of these men now amounts to more than 8000 years.

A notice is sent from the timekeeper's department to designated officials of the company when an employee is entitled to be placed in the 25-year group, also when he passes from this or any other to a longer service group. A "tickler index" aids in carrying this out.

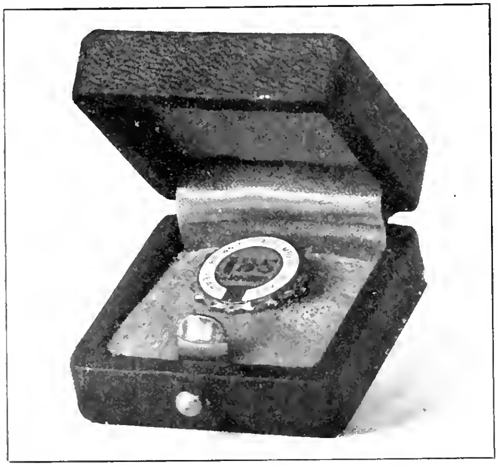


FIG. 3 THE LONG SERVICE PIN WHOSE COLOR VARIES TO INDICATE PERIODS OF EMPLOYMENT OF 25, 30, AND 50 YEARS

While this public record has aroused much interest among those whose names now appear and those who look forward to the time when their names will be entered or transferred to a longer period group, the greatest interest has been shown by the thousands of

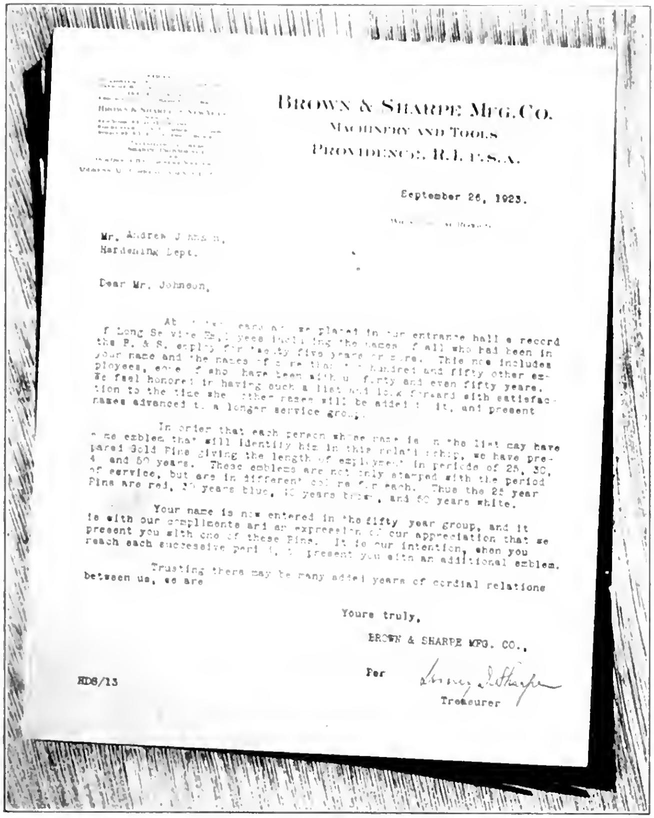
There was some hesitancy to adopting this plan for the pins because of fear that the company might seem to take a patronizing attitude toward employees and thus have the purpose misunderstood. To avoid this and to make the distribution of the pins serve as the

FIG. 4 SHOP ENTRANCE TO RICHMOND VIALL'S OFFICE WHEN HE WAS SUPERINTENDENT AT THE BROWN & SHARPE MFG. CO.

opportunity for a closer personal touch between the men and the management two features were introduced: (1) The presentation of the pins was made personally by an official of the company; (2) a letter of appreciation signed by another official was addressed to each man and handed to him when his pin was presented.

The foremen, more than half of whom were entitled to pins, were first called together and the plan explained to them. Each was given a box containing the pins and letters for his department, and a time was designated when he was to have these men gathered together so that the presentation could be made.

It seemed specially fitting that the presentation


BROWN & SHARPE MFG. CO.
MACHINERY AND TOOLS
PROVIDENCE, R.I. U.S.A.

September 26, 1923.

Mr. Andrew J[illegible]n,
Hardening Dept.

Dear Mr. Johnson,

At [illegible] we placed in our entrance hall a record f Long Service [illegible] including the names f all who had been in the B. & S. employ for twenty five years or more. This now includes your name and the names of [illegible] hundred and fifty other employees, some f who have been with u forty and even fifty years. We feel honored in having such a list and look forward with satisfaction to the time when other names will be added [illegible] it, and present names advanced t. a longer service group.

In order that each person whose name is n the list may have [illegible] emblem that will identify him in this relationship, we have prepared Gold Pins giving the length of employment in periods of 25, 30, 4[illegible] and 50 years. These emblems are not only stamped with the period of service, but are in different colors for each. Thus the 25 year Pins are red, [illegible] years blue, [illegible] years [illegible], and 50 years white.

Your name is now entered in the fifty year group, and it is with our compliments and an expression of our appreciation that we present you with one of these Pins. It is our intention, when you reach each successive period, t [illegible] present you with an additional emblem.

Trusting there may be many added years of cordial relations between us, we are

Yours truly,

BROWN & SHARPE MFG. CO.,

HDS/13

Per [signature] Treasurer

FIG. 5 LETTER ACCOMPANYING THE PRESENTATION OF LONG SERVICE PINS

should be made by the secretary of the company, William A. Viall, so long identified with the business and so closely associated in the past with many of the older employees. His father, Richmond Viall, was superintendent when most of these men entered the employ of the company. Richmond Viall illustrated in a marked degree the policy of personal contact emphasized through the methods here described. This is well indicated by the sign on the shop entrance to his office, which read: "R. Viall—Walk In," (Fig. 4) so well remembered by all of the long-service employees.

Presentation of Long-Service Pins

The pins are a further expression of this same close touch between employer and employee, for many of the officials wear pins identical with those worn by the workmen.

Mr. Viall, in the presentation, explains to each group that they form the connecting link between the old shop and old group of officials, few of whom are now living, and the present organization; and that the pins are presented so that each recipient may have a personal reminder of his long service.

The letter referred to is signed by Henry D. Sharpe, Treasurer of the company, and as it further carries out the spirit of this presentation it is reproduced in Fig. 5.

Many of the long service men have at some time in the past left the employ of the company, later returning. That this has occurred in so many cases indicates that it is often a help toward long service for a man to go away for a time and have the experience of other environment and labor conditions, so that when he later returns he is more likely fully to appreciate the advantages of the old home shop. An opportunity that looks rosy at a distance may not always prove so on close acquaintance.

When figures of turnover are given they seldom take into account prior employment, although men returning often take up the same jobs they left, and should not in a sense be classed as new employees.

In the last year's record of turnover at the Brown & Sharpe works returned former employees totaled more than half of all hired.

As I prepare this article I am in receipt of a letter from a manufacturer in Detroit in which he says:

> I believe that one of the highest recommendations a company can have, aside from its high-grade products, is to retain capable men for a great many years.

He might have added that one of the factors in securing high-grade production is retaining a force of satisfied, loyal workers experienced through long years of service.

The final illustration, Fig. 6 shows William A. Viall presenting emblem pins to 15 long-service men in the tool department. Taken together the length of service of this group totals nearly 500 years in the employ of the company.

FIG. 6 PRESENTATION OF LONG SERVICE PINS AND LETTERS TO GROUP OF TOOLMAKERS TOTALING NEARLY 500 YEARS IN THE EMPLOY OF ONE COMPANY

THE EDITORS' PAGE

For Greater Usefulness

THIS issue of MANAGEMENT AND ADMINISTRATION presents several changes over preceding numbers in the arrangement of the editorial matter. These modifications have been made with the thought that thereby the magazine would be more useful and usable to the subscriber.

Beginning with the front of the issue the contents page is now the first page as you open the cover. There you will find the complete contents, every article, department, and feature, condensed for presentation on the page which you turn to first and easiest as you open the magazine.

Directly following the contents is a page devoted to information about the contributors in the issue. This is a "Who's Who" of the authors of MANAGEMENT AND ADMINISTRATION. Here you will find from month to month facts and comments in regard to men whom you know well, either personally or by reputation—strong, progressive leaders in industry and manufacturing.

The second page following the information about contributors is the Publishers' Page. It will continue to be used as a place to give announcements and facts about the magazine from several angles—editorial, circulation and advertising.

The next change is rather more radical than those already commented on. Beginning on the seventh page from the first of the magazine is the trend department "Conditions and Prospects in Business and Industry." This has been printed at the back of the magazine for the past few months. Its up-to-date fact matter in regard to industry and business is well known to our subscribers. In the belief that it is being consulted first by many, before even the general articles are considered, we have given the department this place of prominence. In this location new subscribers will much more readily discover its worth and usefulness to them.

One other change completes the details of the new arrangement. The department of "Management Data" has been dropped as a set-apart section. However, the special kind of factual matter in regard to accepted practice and classified information will continue to be a feature of every number of the magazine, but it will be edited in the form of an article and will be included among the general articles. The example in this issue is the one by H. W. Maynard, on page 751. The consecutive numbering of these summary and data articles will be retained. Maynard's is number 21. The reason for this change is to make this fact matter more readily accessible and give it a position more in keeping with its value. The elimination of one of the department divisions also tends to make each issue more of a unit as it reaches the attention of the subscriber.

In addition to these rearrangements the cover has been changed to make it more work-a-day in appearance by showing an industrial view in the medallion. Below this picture are listed the contributors.

All of these changes have been made with a single purpose in view, and that is the first aim in our editorial policy, namely, to increase the practical usefulness of MANAGEMENT AND ADMINISTRATION to the management of manufacturing companies.

Producing More Industrial Executives

ONE of the growing pains of industrial expansion is the noticeable shortage of really high-power executives. The demand is insistent; the supply extremely limited. As expansion continues the demand will logically increase, but there is serious doubt whether the supply can be augmented proportionately unless industry resorts to special measures of training and education with that particular purpose in view.

That the situation is really critical was brought out in the recent conference between representatives of a number of educational institutions and American industrial organizations, held under the auspices of the National Industrial Conference Board. During the conference it was predicted that by 1930 an army of newly recruited industrial executives numbering at least 200,000 will be required. But a survey of the educational field now preparing young men for such positions reveals only about 50,000 executives in the making.

Our educational facilities for preparing men for these executive positions are far from adequate. Approximately 9000 graduates a year come from the technical schools, but comparatively few of these ultimately reach positions where their services are of the greatest possible value to industry. As a matter of fact, it was brought out in the conference that not more than 20 per cent of the men who plan and administer the productive work of the United States today are graduates of colleges or technical schools.

In the opinion of many who took part in the conference American industry may need 400,000 more men in 1930, instead of 200,000. The report of the conference says:

> These additional executives would be needed above the figure for mere replacements. Mass production greatly increases the amount of product per worker, but requires a relatively larger increase in the proportion of planners and administrators. The increased uses of machinery and the elaborate methods of control in production and distribution demand a larger number of trained executives, and demand persons of high caliber to begin with. The normal progress in industrial methods and the approaching new competitive condition in industry demand more high-grade men than have been needed before. We must create schools that will produce them, in both quality and quantity.

Another point emphasized in the conference was the adaptation of training to the ever-changing conditions of industry itself. This was put on record in the closing portion of the conference report, which urgently recommends that education in the colleges and technical schools be closely co-ordinated with the new trends that appear in industry as it expands.

The importance of college and technical school training in preparation for management in industry is, of course, self-evident. At the same time it should be kept clearly in mind that other agencies are steadily at work, helping foremen, and superintendents and others to grow into true executive stature, and thus making a definite contribution to the recruiting of the 200,000 or more who are to be needed by 1930. Among these agencies, the organization that stands back of MANAGEMENT AND ADMINISTRATION, with 25 years of service to management through the publication and worldwide circulation of books and periodicals in this field, is glad and proud to be numbered.

An Appreciation of Management

GENERAL MOTORS CORPORATION—one of the great corporate organizations of the country—will, on November 26, vote upon a proposed plan of special compensation, or profit-sharing for its executive officers. As stated by President Sloan:

> In a great structure such as the General Motors Corporation where problems and operations are so diversified, where capital must be employed and plants operated in the best interests of the corporation as a whole . . . it is important to find, develop, and retain men to occupy important managerial positions who are capable of assuming great authority and the responsibilities that make these positions important.

General Motors managers are, of course, already drawing adequate salaries. But to hold them and keep them keenly interested something more than a salary is needed. And this, the present plan—if approved by the stockholders—is to supply in the shape of a contingent bonus. The arrangement is complicated, involving the formation of a holding company, but, stripped of obscuring details, is essentially:

1. A special committee of directors selects the managers who are to be allowed to participate.
2. The managers selected must make a material investment of prescribed amount in General Motors Common stock, this stock to be purchased from the company on easy terms.
3. The stock purchased by the managers is held in escrow subject to repurchase by the General Motors Corporation at any time on prescribed terms.
4. Each year, after reservation from General Motors net earnings of 7 per cent upon the capital employed during the preceding year, 5 per cent of the remainder is set aside for benefit of the chosen managers who participate in proportion to their holdings of the purchased stock.
5. [illegible]

As will be noted, the [illegible] of the managers are all contingent upon [illegible] successful administration of the company's affairs. Their General Motors stock receives the same dividend as any other General Motors stock and there is no bonus unless the net profits exceed 7 per cent upon the capital employed. Moreover the manager's participation is based on individual performance, for any manager falling below the expectations of the Finance Committee is cut down to such participation as that committee deems proper.

As to the amount of the bonus there are too many complications and contingencies to permit of accurate calculation. Dividends upon the managerial stock will, of course, be just the same as on any other common stock of the company. The real bonus is found in the 5 per cent of net profits set aside for the managers after reservation of 7 per cent upon the capital employed during the preceding year. Calculated upon the probable earnings of General Motors for the current year, this 5 per cent amounts to approximately \$2,400,000. If the managers want more than this they can get it by increasing the net earnings of the company and in no other way.

It is expected that some 70 executives of the General Motors Corporation will participate in the profit-sharing plan.

The Material Handling Challenge

WHEN it comes to a real showdown very few industrial managers know what it actually costs them to manufacture their products. So far as direct expenses are concerned, almost any accounting system will supply correct figures. But for burden charges, involving as they do items not easily measured, elaborate systems as well as elementary utterly fail in most cases to give a true picture of conditions.

Guessing at values may work all right for a while, but, even if not forced by necessity to get closer and closer to actual figures, a manufacturer is, to say the least, unwise to forego the extra profits he could readily make by knowing his costs and then intelligently reducing them. Therefore, the American Society of Mechanical Engineers Material Handling Division Committee, which has worked out economy formulas for labor-saving equipment, is to be complimented upon its pioneer work in placing at the disposal of industrial executives a means of determining costs and savings in material handling operations.

But executives will continue to deceive themselves and shackle their organizations with inadequate and expensive methods until they analyze their costs thoroughly and learn the real truth. How many times, in order not to have his figures laughed at, must the plant engineer actually change them so that they show only a fraction of the savings possible with proposed new equipment? If he should present the real facts, the manager would absolutely refuse to believe him.

Mr. Shepard, in his article on "Profit or Loss in Material Handling" appearing in the present issue, stresses this lack of information in the average plant and shows how it stands squarely in the way of improvements and increased profits. His discussion of the formulas and their application leads to questions as to how they will be used in various industries.

The factor of interest on investment will be applied in some cases to mere cost of equipment; in others it will include installation charges; in still others it will take in auxiliary apparatus. The item of insurance may be applied to fire risk only, or it may cover liability for possible injury to employees. Allowance for upkeep presents a wide field for differences of opinion, both as to what elements it includes and especially as to correct percentages to allow for them. Depreciation and obsolescence depend upon the class of service and the amount of work a piece of equipment has to perform. Allowance for power is easily determined because means are at hand for measuring this factor accurately. It is unfortunate, however, that so little is done to determine the power consumption of individual units. The cost of using instruments is insignificant compared with the savings they lead to.

Savings in direct labor are affected by the fact that only intelligent help should run labor-saving equipment. But the extra pay for one or two men is more than recovered in the lower upkeep cost of well-treated machines. The savings in actual burden form the biggest stumbling block because, in comparison with new equipment, the items of burden on present hand methods are entirely overlooked or taken usually from one-half to one-tenth of the correct amounts. Economy of space and avoidance of interference, with less men working, are savings that are not often taken into account.

The possible earnings through increased production include two or three elements not often considered. First of all, every plant should have a factor of safety in the capacity of its production equipment to avoid the "neck of the bottle" trouble. On the other hand, equipment comparatively too large and too efficient is too costly because of its intermittent idleness. Furthermore, a unit less effective on one operation may compensate for this defect by a wide variety of uses which eliminate the necessity for special equipment.

Without further elaboration it is evident that the time is ripe for a thorough practical tryout of the formulas. The committee which developed them is particularly anxious to have them put to the test. MANAGEMENT AND ADMINISTRATION has this urgent request to make of its readers: Apply the formulas honestly to your own equipment both present and contemplated, measuring costs with the greatest possible degree of accuracy. When the results of these individual applications are determined, send them in to the editors who will gladly review the comment and criticisms and will place the reports in the hands of the committee. By such co-operation a far-reaching benefit of great importance to industry will be gained.

The Accountant's Opportunity

IN days gone by the accountant—or bookkeeper—was merely a keeper of the accounts. His chief function was to record financial history. His gaze was fixed on the past, and the future was no official concern of his. Accordingly although he occupied a position in which the vital secrets of the business necessarily came to his knowledge he usually remained a subordinate employee until time, or the vicissitudes of business life, removed him from the scene. The executives of the business entered through other doors.

There are still bookkeepers in the industrial world and they are still mere recorders of financial history, the recipients of modest salaries and of small regard. There has, however, been a twofold discovery which has revolutionized the work of the accountant. The executive on his part has found that the accountant can keep him in close touch with the operations of his business—can tell him what it has done and what it is doing and this so near the event that if results are unsatisfactory or trends unfavorable the executive may act in time to prevent material loss. Beyond this the really competent accountant or statistician can actually tell him what his business is going to do in the future, if it goes on its uninterrupted course, and can tell him this so far in advance that he may take steps to change the charted course if it does not suit him.

On the other hand, the accountant has discovered that his position is one of confidential responsibility—that to him falls the immensely important duty of so keeping and interpreting the records of the business that the executive may have this information that enables him to operate safely—to avoid loss and to win through to greater success. And realizing the importance of his position he has also realized the fact that it is a direct road to the executive chair and better still that it may itself be made an executive position—that under the more exalted title of controller the accountant may himself become one of the important executive officials of his concern.

The importance of the position has been realized by some accountants but not by all. It is well stated by Mr. Bliss in his article "Accounting as an Aid to Executive Control" appearing elsewhere:

> The industrial accountant should be a "self-starter." That is, he should deliver the information his accounts and records develop and should not expect the managers of the business to call for everything they need. As a matter of fact, many of them do not know just what to ask for, and some of them in the stress of daily business are apt to overlook the information which would be of vital interest to them in handling transactions. The accountant sees passing before him in his records the story of the business as it goes on from day to day. It is his responsibility to report the salient points of that story to the management.

How far the work of the accountant and statistician can be carried, how scientific it may be made, and of what value to the executive, is well illustrated by Mr. Barber's forecasting articles which have been appearing for some months past in MANAGEMENT AND ADMINISTRATION. A study of them should convince any accountant of the possibilities of his position.

THE READERS' PAGE

The Yale Tractor

IN the October issue of MANAGEMENT AND ADMINISTRATION, on page 466, was shown a picture of a Yale tractor. The text reference to the picture carried the words "gasoline driven tractor," from which it might be inferred that the tractor illustrated was run by a gasoline engine. The Yale tractor, however, is driven by an electric motor receiving its current from a storage battery.

Calendar Simplification

THE able and energetic secretary of the National Association of Cost Accountants sends the following letter from his stronghold high up in the tower-like Bush Terminal Building:

Editors of MANAGEMENT AND ADMINISTRATION:

In these days of glorious reform, when so many of our immaculate and energetic citizens are busily engaged in improving the moral character and industrial efficiency of the rest of us, I hesitate to inject any further complications into the already more or less involved scheme of industrial salvation. However, there is one idea which has been floating around for some time which seems to me to be worthy of more attention than it has been receiving. I refer to the proposal for "Calendar Reform" which I prefer to call "Calendar Simplification" on account of an unreasonable prejudice against the word "reform" in any connection.

Briefly, the proposal is to replace the present year with its illogical division into 12 unequal periods by a year consisting of 13 months of 28 days each. I shall not take up your time with an examination of the manner in which the present calendar was developed but I recommend an examination of the history of the calendar to anyone who craves such amusement as may be derived from the weaknesses of the great. If it had not been for the ridiculous vanities of the Caesars we would have been deprived of at least this one opportunity for reform.

The resulting situation, however, is perfectly obvious. We are all familiar with the difficulties which develop in attempting to compare monthly results for any sort of business statistics. Take, for example, the difficulty of comparing a February with two holidays and five Sundays, leaving a net of 21 working days, with a March with four Sundays or 27 working days. Many firms have endeavored to overcome this inconvenience by placing their sales statistics, their cost records, or other business data on a four-week basis. This has some advantages, but so long as the calendar remains as it is there is bound to be a great deal of confusion.

Under the proposal each of the 13 months would have exactly the same number of days, 28. Every month would start on a Sunday and end on a Saturday. Each day of the week in each of the months would fall on exactly the same date as in the other 12 months. We have all experienced situations toward the end of the year when it became necessary to fix a meeting for, say, the third Wednesday of the following January. There is an immediate search for next year's calendar because no one is able to tell without calculation or without a calendar on what day of the month the third Wednesday will fall. With a simplified calendar the third Wednesday of January would fall on the same day as the third Wednesday of every month in every other year.

There would not only be a great convenience through a calendar of this sort but there would be substantial economies as well. Printed calendars would no longer be necessary. Until we became familiar with the new calendar it might be necessary to have a one-month calendar before us but all months would be exactly alike and even that would in a short time become unnecessary. The annual costs of printing calendars in the United States alone must run into a tremendous sum of money.

There are, of course, some difficulties and some objections but they are, it seems to me, greatly outweighed by the advantages. Thirteen months of 28 days each would total 364 days, leaving one day over in ordinary years and two days in leap years. It is proposed to dispose of these days by creating a day between the present months of December and January which would be an international holiday. It would not affect the calendar but would provide an excellent opportunity for inventory purposes at the close of a fiscal period. The extra day in leap years would be inserted as an international midsummer holiday.

There is also the objection that a 13-month year could not readily be divided into halves or quarters but an examination of the plan will show that this objection is not well taken because while our present calendar is susceptible of division into quarters and halves of 3 or 6 months respectively, they are not equal as to the number of working days in each, whereas the proposed calendar could be divided into two exactly equal halves of 26 weeks each and four exactly equal quarters of 13 weeks each.

There are minor objections, such as the confusion which would arise in making the change. This would be no greater than the confusion which was connected with the standardization of time some years ago. It would be no greater than the confusion which has attended all calendar reforms in the past. Changing the dates of our anniversaries would mean very little because none of our present anniversaries which date more than 150 years back now falls on the day or date on which the event originally occurred, the birthday of George Washington being an example in point. The calendar has been changed since the date of Washington's birth and I do not believe that the Father of our Country, who was not as a matter of fact born on the twenty-second day of February, would object to another shift in the interests of his children.

To make a reform of this sort practicable it would probably have to be international. A bill was introduced in Congress last year authorizing the President to call an international congress for the reform of the calendar, but it was not reported out of committee. It is probably just as well that the bill was not acted upon because the United States for diplomatic reasons is not in a particularly advantageous position to call such a conference. It has been reported that the League of Nations has the matter under consideration. If this is the case I believe that some organized effort should be made to urge our government to express in such form as may seem advisable its general approval of such a plan and its desire in this particular instance to co-operate with the League of Nations, with due regard, of course, to all "entangling alliances."

I apologize for consuming so much space in the presentation of a subject with which many of your readers are probably already familiar. My only justification is a sincere belief that the suggestion has real merit and a hope that this letter may lead to a discussion of the subject through the columns of your magazine, which may in turn lead to some definite steps being taken.

S. C. McLEOD.

America and the Dye Industry

ENCOURAGING news for all manufacturers who are purchasers of dye-stuffs is contained in the following communication from Professor J. H. James, head of the Department of Chemical Engineering at the Carnegie Institute of Technology:

Editors of MANAGEMENT AND ADMINISTRATION:

The probability that America will soon achieve supremacy over Germany in the manufacture of dye-stuffs is evidenced by the fact that the United States now produces about 93.5 per cent of the dyes actually consumed in this country. While it is still necessary for this country to import the other 6.5 per cent from Germany and Switzerland, it is clear that America's ability to shift for herself in the dye industry is an indication that eventually she will supply most of the dyes used throughout the world.

Germany was the original home of the dye industry. Up to the time of the war she had accomplished more in scientific research in dye-making than any other country. From 1870 to 1914, the "golden age" of German dye-stuff manufacture, there took place the most remarkable development in chemical manufacture in the history of the world. The German government extended long-term credits to the firms engaged in research work and development of this kind, and the manufacture of this product. Consequently Germany made itself known everywhere as the leading dye country of the world.

In a new country, like the United States, capital secured greater returns from mine, timber, railroad, and steel development. Industrial leaders naturally did not become interested in an industry that required an outlay for equipment and continued research such as the Germans were putting into their organic chemical manufacturing.

Furthermore, our patent laws are so framed that an American patent gives a foreigner a monopoly in this country, whether he chooses to make the patented product here or not. Thus the Germans had the double advantage of protection against competition in our market, and cheaper labor, recruited from the abundance of men trained in chemistry by the universities and technical schools of Germany.

Before 1914 the textile manufacturers, obviously the biggest consumers of dyes, never helped the American chemical manufacturers to develop a color industry on this side of the Atlantic. As a straight business proposition they figured that they could always secure their dyes more cheaply from Germany, where this industry was first developed. Thus the history of American color manufacture up to 1914 is one long record of attempt after attempt, followed in practically every case by failure. In 1914 there were but seven small, struggling firms engaged in this line in the United States.

Now that the war is over, it seems fairly evident that the German government had a sinister motive in gaining supremacy. Control of the dye industry may have been more than an economic measure. Theoretically, at least, every chemical plant making dyes is potentially a plant for the manufacture of munitions, since the apparatus and skilled men used in the first stages of manufacture can be turned over, in a short time, to the manufacture of high explosives.

Soon after the war broke out, with the English blockade in force, the need for dyes became so great that action here was imperative. Chemists became interested in the work, and the manufacture of American dyes was begun on a larger scale than had ever been possible before. Of course, it was poor stuff that was produced at the beginning. That was expected. Colors faded and ran, and the textile manufacturers were up in arms. That was expected, too, but progress has been steady and consistent, and America is now taking its place in the world as a manufacturer of dyes.

According to a recent report of the United States Tariff Commission, there were in 1914 but seven American firms, that manufactured a total of 6,619,729 lb., valued at $2,470,096. In 1922 the sales of 87 American firms manufacturing dyes totaled 69,107,105 lb., valued at $41,463,790. The average sale price of domestic dyes for 1922 was 60 cents per lb. as compared with 83 cents in 1921 and $1.26 in 1917. In 1914 the imports of dyes were nearly 90 per cent of our consumption, the imports then totaling 45,950,785 lb. Imports in 1922 were but 6.5 per cent of our consumption. We are certainly moving in the right direction, and at an encouraging rate of speed.

J. H. JAMES.

The Accountant as Forecaster

THE letters of C. H. Stephens and Frederick H. Hurdman in the October issue of MANAGEMENT AND ADMINISTRATION have drawn the following interesting comment from D. A. Sargent, Certified Public Accountant practicing at Oakland, California:

Editors of MANAGEMENT AND ADMINISTRATION:

I have read with great interest the letters of Mr. Stephens and Mr. Hurdman in your October issue.

During the past two years I have put into practice many of the suggestions outlined by Mr. Stephens, believing that it was to the best interests of my clients to do so. We prepare a monthly survey for many of our clients, containing statistical data concerning their business, the business of similar organizations in this locality and throughout the country, together with a review of general business conditions, and especially such phases thereof as may bear upon the particular business or industry which we are serving.

For a particular group of clients, who have received this service for a period of two years, we have had exceptionally satisfactory results. We believe that we have shown an additional $100,000 a year profit in five concerns; that this represents an increased profit of 5½ per cent over and above that which they were previously making; that the service rendered by these organizations has been bettered. Sales prices have not increased during the period but in some cases have decreased; the wage rate to employees (constituting more than 60 per cent of total costs) has increased. There are also certain more or less intangible benefits, not reflected directly in the operating statements, such as savings made by investing or building at just the right time to receive the greatest possible value for a given monetary outlay.

We believe out here that the business executive who has no real measuring stick to apply to his business once a month or oftener, is under a serious handicap when compared with the executive who is working toward a definite goal, set up in accordance with indications as to the economic conditions of the near future. We accountants know the severe trials manufacturers and business men generally have gone through during the past few years. We are in a peculiar position. We see the heart of industry beating, and we should be able to determine its true condition as accurately as does the trained medical or surgical diagnostician.

Personally I have never had the privilege of association with any of the larger accounting firms in the United States. I doubtless lack the viewpoint of the trained routine worker in auditing or accounting. Through sheer necessity I have developed the statistical, cost, and production control phases of practice, believing them to be of ultimate value to my firm and its clients.

Our experience is that the articles published in MANAGEMENT AND ADMINISTRATION are of far more practical value to the accountant who desires to qualify as advisor to business executives than are those offered in accountancy magazines. We believe that accountancy [illegible] and superintendents.

We believe that the [illegible] of financial and operating ratios between [illegible] the same industry or branches of the same [illegible] makes for better understanding of all problems.

These means of reflecting conditions are of far more value to the executives concerned than the presentation of the customary balance sheet and statements. I do not mean to cast reflections upon these usual statements, but merely to show that they are but the basis for the presentation of comparative data, which are of more vital use to the business executive of today.

D. A. SARGENT.

Securing Additional Capital

THE writer of the following letter asks, for obvious reasons, that his name be not disclosed. The editors will, however, be glad to provide space on the Reader's Page for any suggestions that the readers of the magazine may offer toward the solution of the problem here presented.

Editors of MANAGEMENT AND ADMINISTRATION:

I am the manager and largest stockholder of a small manufacturing company doing business of some $200,000 a year. We are paying expenses with fair comfort, but are not making money—that is, after salaries have been paid and proper reserves been set aside there is practically nothing left for surplus.

Manufacturing and selling on the present basis we can hardly expect to do better than at present. In some other way the turnover must be increased, and the question that is puzzling me is how this is to be done. We are working now up to the limit of our available capital. To increase our output we must enlarge our facilities—we own our equipment, the plant in part—but for this lack capital. Also, an increased output would involve a larger and more expensive office service and more margin for selling.

On the face of it the answer is, get more capital, but this we find difficult. We cannot put in more ourselves; we have not sufficient standing to sell stock or bonds. Is there any other way out?

I might add that we wrote New York investment brokers asking if it would be possible for them to sell an issue of bonds amounting to $50,000 and secured—and well secured too—on our unencumbered plant equipment. The answer was a turn-down, the brokers stating that the issue was too small—that it would not even justify the cost of the investigations and preparatory work they required before they would put themselves behind a bond issue.

Any information you can give me will be very greatly appreciated. I am sure there must be others in the same predicament as ourselves.

NEWS OF EQUIPMENT
FOR THE MANAGEMENT

This department is conducted to give the essential facts in regard to new equipment which may be used in the operation of manufacturing concerns. As the sources of the items are reputable manufacturers, MANAGEMENT AND ADMINISTRATION accepts this information as reliable. —THE EDITORS.

A Recording Safe for Industial Savings

Index Number
658.446 Industrial savings

THE Auto-Teller, a recording safe for use in industrial establishments to collect savings of the employees has been through a period of trial and preliminary installation and is now ready for the market. In principle it is simple. Deposits can be made in any amount represented by the denominations of paper money, as \$1, \$2, \$5, \$10, etc. A part of the equipment is specially designed envelopes and passbooks which make the receiving and receipting for deposits mechanical and semiautomatic.

FIG. 1 THE AUTO-TELLER RECORDING SAFE

The special envelope used by the depositor is of the window variety and takes one bill of any denomination. After the bill has been inserted and sealed the envelope is inserted with the passbook in a folding metal frame. This frame or slide is then inserted in the slot in the safe corresponding to the denomination of the bill and the accompanying lever is pressed down. This action by the depositor deposits the envelope in the safe and stamps a receipt for the money in the envelope upon the passbook page. By the same mechanical action a slip is attached to the envelope identifying the depositor.

The auto-teller is intended to be installed in industrial establishments in easy access of employees, thus permitting the making of deposits without going to a bank. At the same time the banking affairs of the employee are secret, for the auto-teller is opened by representatives of the bank or banks which co-operate with the employer in installing the device and providing the thrift service for the employees.

The manufacturer of the auto-teller is the National Automatic Teller Corporation.

A Motor That Corrects Power-Factor

Index Number
658.26 Power-factor in industry

THE losses in industry due to the low power-factor of induction motor equipment have been a matter of intensive discussion for several years. Little or no inducement has been offered power users to compensate for the higher first cost of high power-factor apparatus and this has retarded the general development and introduction of high power-factor motors. At the present time the situation is in process of correction, however, by introduction of penalty clauses in some power contracts for power-factor of load below certain minimum figures and bonus clauses for high power-factor in others. The effect of this will be to stimulate the development and application of high power-factor apparatus.

Based on the best statistics obtainable the total amount of alternating-current energy distributed to consumers for power purposes, in the United States, is about 50 billion kw a year. As practically all this power is employed in induction motors whose average power-factor is certainly no higher than 70 per cent, this means that about 71 billion kva of current must be generated.

Generators, transformers, switch gear, wires, etc., must be provided, both by central station and consumer, on the scale commensurate with 71 billion kva, in order to supply 50 billion kw. The "frozen in-

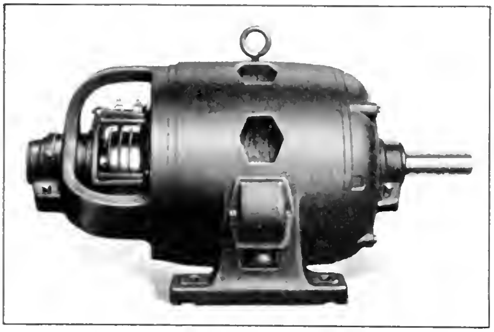


FIG. 1 THE FYNN-WEICHSEL MOTOR

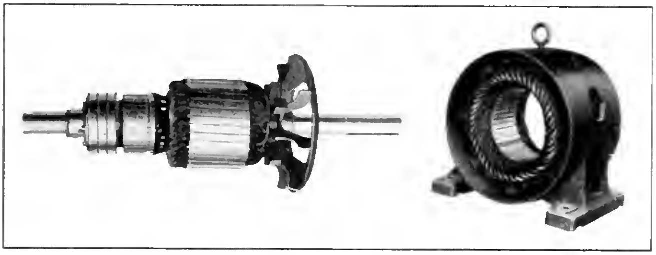


FIG. 2 ROTOR AND STATOR OF THE FYNN-WEICHSEL MOTOR

vestment" due to the 21 billion kva of idle current has been very conservatively estimated at $750,000,000 (the total present investment in the United States in central station equipment is about $5,400,000,000; consumers' equipment represents probably an even larger amount).

Direct operating losses due to idle current are also considerable. I^2R losses are, of course, proportioned to the total current and not merely to the working current, and are usually much heavier on the consumer's side of the meter than on the central station side. A fair estimate is believed to be, from the best figures available, $28,000,000 a year on the central station side, and $79,000,000 a year to consumers. This loss must, of course, be capitalized.

It is a fair statement, therefore, that the present capital cost to American industry, of poor power-factor and the resulting idle current, is around $2,000,000,000, and probably more.

Because of these losses interest is at once centered in the economic aspects of a motor recently put on the market. This is the Fynn-Weichsel motor developed by the Wagner Electric Corporation. A general view of the machine is shown in Fig. 1 and the disassembled stator and rotor in Fig. 2. Without going into details of its electrical or mechanical construction it consists of a stator with starting and operating windings and a rotor carrying the load and exciting currents. The rotor windings are connected to a commutator and slip-rings of the usual construction. Brushes bearing on the commutator suitably interconnect the stator and rotor windings. The starting characteristics are identical with those of the induction motor with the difference, however, that the usual slip-ring motor has running speed with full load of 95 or 96 per cent of synchronous speed, while the Fynn-Weichsel motor operates at synchronous speed. With a load which does not exceed full load by more than 25 to 50 per cent the motor will continue its increase in speed without change in operating connections, until synchronism is reached. That is, the motor starts as an induction motor, increases in speed to synchronism, and operates as a synchronous motor to a load of some 150 per cent, when it continues to operate as an induction motor until the load is sufficient to cause breakdown.

The motor, therefore, can be used to correct the power-factor in induction motor installations or to secure unit power-factor for complete installations. In the former arrangement lies the great advantage, for it is unnecessary to replace all existing equipment with these motors to bring the power factor of the whole system to unity. Thus induction motors having the poorest power-factor can be replaced so that the others will be compensated for and the desired result secured.

This new motor, therefore, offers a solution to the central station power-factor problem as created by industrial motor load, and offers to the industrial management means whereby substantial improvements can be made in the economy of operation of motor equipment.

Indicating and Recording Steam Meter

Index Number
658.26 Power-factor in industry

THE instrument illustrated is designed to measure the quantity of steam used in the operation of engines, pumps, blowers, heating systems, drying rooms, and similar purposes. It is also used to determine the amount of power required by the different departments or operations in manufacturing plants. It is known as the St. John indicating and recording steam meter, manufactured by the American District Steam Company. This meter measures the flow of either saturated or superheated steam at all pressures and under either steady or varying loads. Its only moving parts are the valve and spindle which float in the current of steam. The vertical movement of the valve is transferred to the pointer, which indicates in horsepower the rate at which steam is being used. At the same time the brass pencil records the flow of steam on a metallic treated paper ribbon operated by clock work and moving at the rate of 1/2 in. per hr. The clock movement requires winding but once in 8 days.

The principle upon which the meter operates is that with a uniform difference of pressure on two sides of an orifice through which steam is flowing with constant initial pressure, the quantity passing bears a direct relation to the area of the orifice. The valve is so tapered that the delivery of steam is increased in

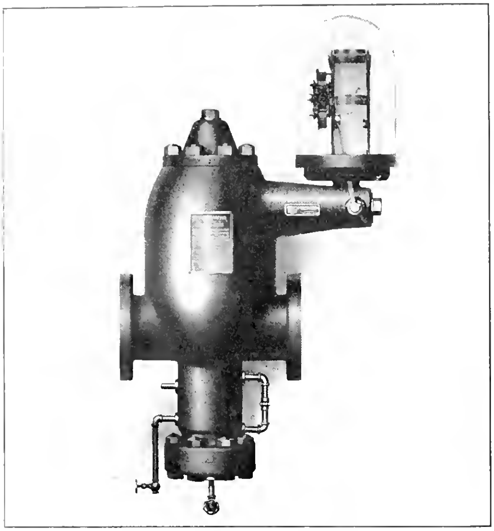


FIG. 1 ST. JOHN STEAM METER

direct proportion to the rise of the valve, so the greater the steam demand the higher the valve floats, and all the steam to be measured passes through the meter.

The chart, with its horizontal divisions ½ in. apart, each representing one hr., is drawn under the pencil point with a uniform vertical movement, while the pencil traces a line which remains as a record of the rise and fall of the meter valve, and hence of the rate of flow of the steam at all times throughout the day. This line so drawn is called the "steam line."

These valves are made in sizes from 1 in. to 6 in., and for hp. at 100 lb. pressure ranging from 27 to 1000.

Turbo-Generator and Turbo-Fire Pump

Index Number
658.261 Power generation

TWO small turbine driven units, one a turbo-generator lighting set, the other a turbine driven fire pump, are shown in the accompanying illustrations. They are manufactured by the Standard Turbine Corporation.

The turbo-generator set known as "Standardlight" shown in Fig. 1 is intended for use with isolated electric lighting installations, as an emergency set in power-houses and boiler-rooms, and as a source of supply of current for electro-magnets for cranes and hoists. This set is generally built to supply a current at 125 volts, and in capacities from 400 watts to 10 kilowatts. It is intended for non-condensing service and will operate under a steam pressure as low as 50 lb. per sq. in.

The design of the machine is compact, which lends it to portable or semi-portable service, and each unit is self-contained, no foundation being needed. Each set is furnished complete ready for connection to electric light wires and requires no additional rheostats nor storage batteries.

The turbine-driven centrifugal fire pump for use in factories, office buildings, and similar locations developed in conjunction with the Dayton-Dowd Co., is shown in Fig. 2. The turbine has been designed for ruggedness and simplicity. Both bearings and shafts are heavy, and blading is both non-corrosive and non-erosive. The pump has split casing, with suction and discharge opening, cast integral with lower half casing. Both turbine and pump are mounted on a base plate and are connected by means of flexible coupling.

Modern building construction practically always includes some sort of fire protection independent of the

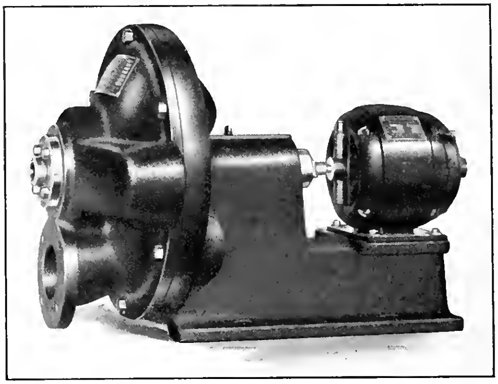


FIG. 1 THE "STANDARDLIGHT" GENERATOR SET

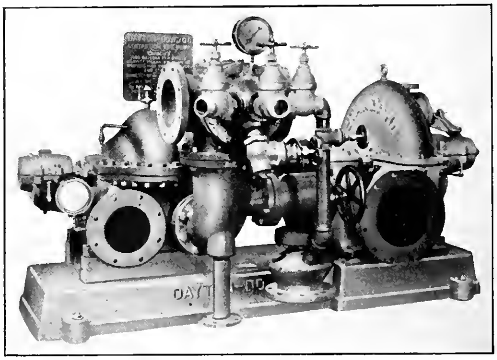


FIG. 2 A SELF-CONTAINED, TURBINE-DRIVEN CENTRIFUGAL FIRE PUMP

local fire-fighting forces. The fire pumps are usually steam turbine driven on account of the capability of pumping against a widely varying pressure, smaller space occupied, full capacity at reduced steam pressure, and high efficiency of both pump and turbine end of the unit.

The characteristics of the centrifugal pump make it impossible to develop excessive pressure in the discharge piping with consequent breakage of valves, piping, and hose. The absence of vibration and water hammer are also points of the greatest importance to life of pump and piping.

A Fuel and Air Control Valve

Index Number
658.26 Power-factor in industry

THE need for accurate temperature control in connection with industrial processes has brought a demand for control equipment which can be applied to oil, gas, and electrically heated ovens, furnaces, and the like. Good results can only be secured by proper co-ordination of all factors involved which influence the supply of heat and resulting temperatures. To meet this need and provide a device for automatic temperature control, the Bristol-Fuller control valves have been developed and are manufactured by The Bristol Company. They are applied to control the flow of air and gas, air and oil, or steam and oil; also for the control of air, gas, steam, oil, and other liquids. The valve shown in the accompanying illustration is for the automatic control of air and oil.

In this apparatus both the fuel and air valves are operated by an electric motor. The valves are adjusted to give a high flame of perfect combustion which will bring the temperature of the furnace slightly above the temperature wanted. As soon as the furnace has reached a temperature higher than desired, the instrument makes contact, operates the motor, and closes the valve to a low flame position. In this way control is secured.

The power units of these valves consist of three parts, gear box, motor box, and switch. The gear box is closed to hold oil for six months' lubrication, and the gears run either steel to bronze or steel to cast iron. The motors are standard make, either A. C. or D. C.

The valves are made to be set and arranged in various positions. In the one shown the air valve is of a butterfly or damper design suitable for pressures not over 2 lb. per sq. in. [illegible] for vertical installation in [illegible]. There are two passages, one for the high flame and the other for the low flame. A cam opens a poppet valve in one passage and closes a poppet valve in another when the flame changes from one to another intensity. This permits a fine adjustment.

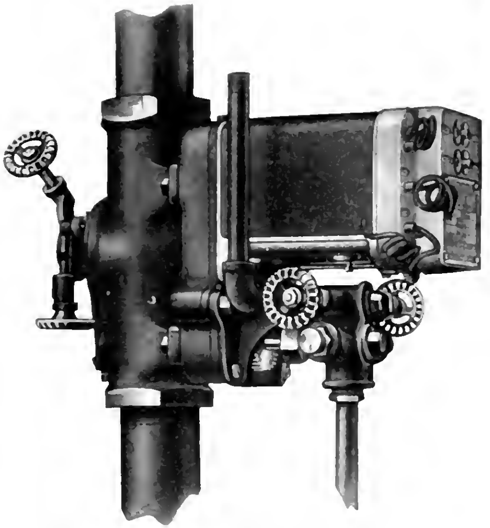


FIG. 1 A BRISTOL-FULLER CONTROLLER VALVE

Internal Gear Drive Tractor

Index Number
658.2812 Hauling equipment

A NEW tractor designed with an internal gear drive has been brought out by the Mercury Manufacturing Company as an improvement over their worm drive machines. The purpose has been to secure an increased working efficiency in the operation of electric industrial tractors.

Fig. 1 shows this new machine known as Mercury Type H. A few of the important features of design are: The motor is General Electric, automotive type; the draw bar pull with 18:1 gear reduction is 475 lb. normal, 1700 to 1800 lb. maximum; with 24:1 gear reduction, 600 lb. normal, 2000 to 2100 maximum; the battery equipment for the 18:1 gear reduction is 30 cells of Edison or 18 cells Exide Ironclad, for 24:1 reduction 42 cells of Edison or 24 cells Exide Ironclad. Speed, no load, with 18:1 gear reduction, $7\frac{1}{2}$ miles per hr.; with 24:1 reduction $6\frac{1}{2}$ miles per hr. Capacity for hauling a trailing load with normal draw bar pull is from 8 to 10 tons.

FIG. 1 MERCURY TYPE H INTERNAL GEAR DRIVE TRACTOR

Curves worked out for the Mercury Type H, or gear drive, and Type L, or worm drive, tractors show (when reduced to the simple elements of ampere consumption, draw-bar pull and speed) that at 200 lb. draw-bar pull the gear-drive tractor has a work-output efficiency of 23 per cent over the worm drive, at 600 lb. 28 per cent, and at 800 lb. 40 per cent.

CURRENT BOOK REVIEWS

Kent's Handbook—An Institution

KENT'S MECHANICAL ENGINEERS' HANDBOOK. *By the late William Kent, and Robert Thurston Kent, and a staff of specialists. 2247 pp. John Wiley & Sons, Inc.*

REVIEWED BY L. P. ALFORD

Editor of MANAGEMENT AND ADMINISTRATION

Index Number 62(02) Engineering handbook

AN established handbook is more than a publication—it is an institution. This position of worth and esteem is held by the book under review, which was first published in 1895 and has been distributed to a total of some 160,000 copies. In the 28 years since it was brought out there have been many and sweeping changes in mechanical engineering. Branches of the science which at one time held first rank have dropped to a minor position, while other divisions have come into existence or have developed to the importance of first place. A handbook to cover a field of such a growing science and art must pass through repeated revisions, and such has been the history of Kent's Handbook. Former revisions have followed in the main the lines of the first edition. The one under review, however, shows marked changes, so much so, in fact, that it can be said with truth that the book has been rewritten.

The fundamental idea of the founder, William Kent, was that the book should be a work of reference of engineering practice. This point of view has been rigorously retained and the material presented has been selected to represent modern practice, the guide in selection being that the information was used by the contributors to the revision. In the use of contributors is found possibly the greatest departure from previous editions. Robert Thurston Kent, a son of the founder, was editor-in-chief of the work, and around him gathered some 35 specialists each of whom has prepared that part of the handbook on the subjects with which he was particularly familiar. This method is coming to be accepted as the most feasible and satisfactory plan for handbook authorship.

A few new features of arrangement are worthy of mention and commendation. Wherever new constants have been discovered the tables depending upon them have been recalculated. In presenting formulas the notation of the formula is given immediately below the formula itself instead of at the head of the section. In paging the book care has been taken to bring on the same page or on facing pages the reference and the table, formula or illustration, to which it refers.

In volume of matter this tenth edition is 56 per cent larger than its predecessor which was issued in 1916. The word content is 2,250,000, and the reference matter is made available for use by 112 pages of index. There are 26 sections in all. The largest, that on machine design, covers 200 pages, and contains 200,000 words.

It is impossible in a review of this kind to comment on all of the new material or even on all which is worthy of emphasis because of its especial value. However, references to a few such features will show the quality of the other and indicate the value of the book as a whole.

Section III, on "Materials," has been largely increased over preceding treatments. A particularly valuable addition is tables of commercial materials.

Section IV, on the "Strengths of Materials," has been entirely rewritten and its matter made particularly valuable by bringing together associated information.

Section V, on "Corrosion of Iron and Steel," has been rewritten and now contains particularly valuable tabular matter on specifications for industrial steel products.

Section VII, on "Non-Ferrous Metals and Alloys," is entirely new and contains a series of tables presenting the composition and physical properties of common alloys in sufficient variety to meet any ordinary industrial need.

Section VIII, "Heat," brings up to date accepted practice of pyrometry, heat insulation, and kiln drying of lumber.

Section IX, on "Air," is new. A group of charts bring together the factors which must be considered in selecting a fan or blower for any particular service, and show what combinations and proportions are suitable for any given set of conditions.

Section XV, "Power Transmission," has been practically rewritten and the belting information is now based on the Barth formulas.

Section XVII, on "Hoisting and Conveying," has been rewritten to present up-to-date practice on the application of hoists, cranes, coal handling machinery, conveyors, tractors, trucks, and industrial locomotives.

Section XXII, on "Buildings," is new, presenting the fundamentals of building construction with a special treatment of reinforced concrete as a material of construction.

The final section, XXVI, on "Safety Engineering," is likewise new. It treats of accident prevention, safeguards in the transmission of power on both wood and metal working machinery, and on miscellaneous equipment. It also treats of electrical hazards, safety factors in the design and layout of industrial buildings and plants, protection of the eyes, safety wearing apparel, first aid, and the supervision of safety work and safety education.

The practical and useful nature of the information presented is but hinted at in these few references. In general, theory has not been treated of, but the matter has been held closely to engineering data drawn from practice and believed to be of daily usefulness.

The Scope of Economic Consumption

A THEORY OF CONSUMPTION. *By Hazel Kyrk. 298 pp. Houghton Mifflin Company.*

REVIEWED BY RUDOLPH M. BINDER

Professor of Sociology, New York University

Index Number
339 Economic consumption

PREVIOUS to the industrial revolution the most urgent need of society was greater production. Owing to the limited amount which could be produced by hand, people were frequently in want. It was inevitable under these conditions that the chief problem confronting the earlier economists was production. Machinery has solved that problem to a very large extent, and a new problem has arisen about consumption. Comparatively little has been written on this topic by economists, since it has become a problem only in recent times and only in a few countries.

The present book deals exclusively with consumption. It is one of the prize essays in the Hart, Schaffner and Marx competition. The prize was certainly well deserved, although the book is obviously badly named. The title might better have been "A Theory of Economic Consumption," thus avoiding the inevitable connotation of tuberculosis. Economists are perhaps too prone to assume that their terms are readily understood.

The following topics are treated: "The Nature and Scope of Consumption;" the "Consumer's Freedom of Choice, as Affected by the Unequal Distribution of Wealth, the Technique of Production, and the Producer's Quest for Profits;" the "Marginal Utility Explanation of Consumer's Choice;" "Values and Valuation Processes;" "Standards of Consumption;" the "Origin of Standards of Living;" "Changes and Development in These Standards;" "What is a High Standard of Living?"

These topics readily suggest the breadth of the treatment of consumption. As to depth the author confesses that she found more problems unsolved at the end of her investigation than she had anticipated at the beginning. That is a wholesome confession and proves the thoroughness of her work. The scope of the treatise may be indicated by a brief discussion. Take the word "consumption." It means a study in price theory to the specialist in economic theories, a study of demand to the man interested in commercial organization, a study of household budgets to a person interested in how the other half lives, etc.

Again, who is the consumer? Every man comes under this heading in many ways. Technically, the consumer has three separate problems: choice or budget making, buying or marketing, and using the concrete commodities. These problems imply the control and guidance of economic activity, the determination of choice or valuation, and the idea of human welfare as a function of wealth.

The study of consumption leads thus inevitably into some kind of sociological theory. The problem of production is no longer one of mere quantity of goods but one of quality and of kind. Clothes may be produced in abundance, but do they serve the purpose of keeping a person warm in winter and cool in summer? Again, Scotch whisky may be of excellent quality, but how does it affect human welfare? The kind of goods produced becomes thus an important problem of welfare. But suppose that the goods produced would advance that welfare, the question would still have to be answered, whether the social cost was not too high. Are the workers speeded up, or are they "sweated"?

Suppose again that these questions are answered satisfactorily, another problem immediately suggests itself. How is consumption to be guided in order to call for the right kind of production? Is the individual to follow merely his pleasure, or is he to regard the welfare of others? What is welfare? Is it the accumulation of consumable goods or the growth of personality? People may, however, be guided by the loftiest conceptions of consumption, and still leave the problem unsolved. The producer seeks profits, and he will furnish goods with that end in view. How can he be induced to produce not only what the consumer should have, but furnish it at a reasonable price? The conversion of the producer to the idea of social welfare is thus necessary.

The problem of consumption stirs up a regular hornets' nest of other problems. It brings economics much closer to ethics and sociology than a study of production. The author has done well to call attention to this phase of economics, since the interdependence between producer and consumer is constantly increasing, owing to a more minute division of labor. Every man is both producer and consumer, and he should have high standards both as to what he sells and buys. The author deserves considerable credit for having called attention to the numerous and complex questions involved in a study of consumption.

The People as Associated Consumers

CO-OPERATIVE DEMOCRACY. *By James P. Warbasse. 193 pp. The Macmillan Company.*

REVIEWED BY THOMAS CONYNGTON

Of the New York Bar

Index Number
334 Co-operation

THERE is the best of reasons why everyone at the present time should be interested in the solution of some of our most serious economic problems proffered by co-operation. The cumulative body of dissatisfaction with the manner in which a large part of our industries are administered is increasing rapidly. Socialism proposes one solution that is radical and compulsory. Co-operation proposes another that is voluntary and involves only an inconsiderable change of present conditions. The objection to the socialistic scheme is that it has never worked, and where it has been tried it has resulted in disaster. The unanswerable argument for co-operation is that it has been tried and has succeeded and is in successful operation in many parts of the civilized world.

Mr. Warbasse is president of the Co-operative League of America and by experience and faithful study is thoroughly qualified to instruct those who would inform themselves exactly what modern co-operation is and what it has accomplished and is accomplishing at this time.

He warns against the insidious progress of state socialization and its effects. We are repelled by the bald statement of the socialist who proposes that the government shall forcibly own and operate all the instruments of production, but meanwhile, as Mr. Warbasse says:

> The socializing tendency of the state is seen everywhere. More and more of the private functions are passing into the hands of the state. As we look back over the past century we see the schools, libraries, highways, postal service, fire-extinguishing, water supply, street cleaning, sewage and garbage disposal, and a hundred other functions pass from private hands into the hands of the state. Governments all over the world are moving toward state socialism.
>
> A certain inevitable result follows this trend: the more industries that are owned by the government, the more dominating and complex does the government become. Still the world is moving on toward this complexity and domination of governments.

Few people recognize the extent to which the socializing trend has gone among those classes that are not suspected of believing in socialism. The workingmen, the union laborers, are not as a general thing much concerned with socialism. Generally the unions are strong and are able to hold their own in the struggle with capitalism for a share of the spoils. It is only when they get the worst of it as in some parts of their controversy with the railroads that they advocate government ownership. It is not the manual workers but it is the great middle classes that are gradually becoming permeated with socialistic theories and more and more look to government to relieve them from high prices and the extortions of, say, the coal men, operators, and workers inclusive. Few people realize the extent to which the so-called "white collar class" resent the manner in which they are exploited in rents, fuel, and other necessaries of life.

To all of these the theory of co-operation should appeal. Co-operation is the reverse of socialism. Socialism looks to the state. Co-operation looks only to voluntary effort by those most interested. Socialism means the forceful operation of all the great industries by the state and the compulsory retirement of all private effort in this line. Co-operation depends on peaceful operation by citizens and no private industries will be disturbed unless co-operation proves itself economically to be the better system.

> There can be no such thing as a state-controlled and administered co-operation. It is an impossibility. When people are compelled to join societies, and when the machinery of government finances and conducts societies, they may serve the people but it is not co-operation, because co-operation is a voluntary movement of the people to administer their own affairs independent of the political state.

Of its wonderful successes in different parts of the world Mr. Warbasse gives us up-to-date information. Few realize what this is. Today the co-operative societies of Great Britain have a membership of nearly five million families; this means one-third of the total population. They distribute to their members over a billion dollars' worth of commodities annually. The surplus savings of these societies in 1920 amounted to $125,000,000. The English Co-operative Wholesale Society owns 116 factories and productive industries. Its banking department had a turnover of $2,500,000,000 in 1922. It owns 33,000 acres of farm lands in England. It owns 10,000 acres of wheatland in Canada. Jointly with the Scottish Wholesale it owns 35,000 acres of tea lands in Ceylon and India. These two societies are the largest importers of tea, grain, butter, sugar and dried fruits in Great Britain. And this is only the beginning of the account of profitable co-operative achievements in different parts of Europe.

Co-operation is a democratic movement for it is "of the people, by the people, and for the people." It is the sane and natural reaction of the plain common sense of the people against the revolutionary and compulsory enlargement of government powers proposed by the socialists. Whether individually you believe in it or not, it is expedient for all those interested in any form of our present competitive business to understand how it is threatened by socialism on the one hand and co-operation on the other. This book, while unnecessarily diffuse, presents the situation along these lines as it exists today.

First Handbook for Accountants

ACCOUNTANTS' HANDBOOK. *Edited by E. A. Saliers. 1675 pp. The Ronald Press Company.*

REVIEWED BY ROBERT E. CONNOLLY

Treasurer, Illinois Central Railroad Company

Index Number 657(02) Accounting handbook

THE latest publication of The Ronald Press Company, the "Accountants' Handbook," is the first attempt to supply the accounting profession with a convenient reference book, such as has been enjoyed by engineering, and other professional bodies.

The convenience of the book is best illustrated by the novel method of indexing employed. We generally expect, upon opening a book, to find a title page, preface, and after some search an index. Not so with the "Accountants' Handbook." The first thing to meet the eye is an alphabetic and numeric list of the 33 sections into which the book has been divided.

This first indexing of the 33 sections is supplemented by a detailed list of the contents of each section, which is repeated at the head of the several sections. If by any chance we are unable to classify our inquiry, a most comprehensive index will lead us at once to the desired section.

The general scheme of the book is to place in the hands of practicing accountants, and that vast army of executives whose duties require a knowledge of accounting and related subjects, a book at once convenient, concise, and authoritative. The book bears the name of E. A. Saliers, Associate Professor of Accounting, Northwestern University, as Editor, and a list of special contributors, all well and favorably known in their respective fields.

A striking feature of the book is that while brevity seems to have been the aim throughout, in no case has clarity of presentation been sacrificed to attain that desired brevity.

A section on taxation which includes a concise description of Federal Income Tax procedure with cross references to depreciation in connection with taxation, as well as a section on mathematics, should make this book a valuable guide not only to those to whom it is addressed but to individual and corporate trustees, owners of real property, and the many individuals who through ignorance, prejudice, or both, prefer to make their own returns to the government rather than avail themselves of the services of reputable public accountants.

In reviewing a book of this character, one's first impulse is to seek out the section dealing with those matters in which he feels his own knowledge to be well organized. There he finds without exception what he thought should be embodied in a book of this character, and he is agreeably surprised to find forms and data of accepted and acceptable standards. Wandering afield into such subjects as accounting for personal representatives illustrated by typical transactions, labor control, wage-payment plans, price levels and quantities, foreign exchange and the numberless other subjects with which one has a bowing acquaintance, one is at once impressed with the logical presentation and balance maintained throughout the work.

There is a glossary of 32 pages, of which it is said: "The definitions which follow are not intended to take the place of a dictionary, but rather to serve as a convenient explanation of terms most frequently used by accountants." Used also, the reviewer might add, by bankers, lawyers, and financial managers.

In the preface we are told: "The experience of users may lead to the detection of minor errors, or disclose the desirability of further developments in the structure or content of this handbook." Minor errors there may be, but a careful and thoughtful examination of the work convinces the reviewer that the task of improving the content will not be the easiest one in the world.

Development of the Credit Union

CO-OPERATIVE BANKING. *By Roy F. Bergengren. 398 pp. The Macmillan Company*

REVIEWED BY LEO DAY WOODWORTH

Deputy Manager, Savings Bank Division, American Bankers Association

Index Number
334.2 Co-operative
banking

THE author, who is Executive Secretary of the Credit Union National Extension Bureau, opens his first chapter with the statement:

> This book is concerned with the credit union as an exemplification of the possibilities contained in co-operative banking. While the credit union is its primary concern, it has to do directly and indirectly with other types of co-operative banking and the whole is designed to illustrate what are the essential principles involved in the subject and to [illegible] reasonable [illegible] co-operative [illegible]

This volume of some 400 pages contains a considerable assortment of material on the broad subject of co-operative credit and mutual savings although some of the matters to which it gives no attention seem to be as pertinent as matters which are included, if not more so. For instance, frequent reference is made to the so-called co-operative banking of the Brotherhood of Locomotive Engineers in Cleveland although no mention is made of the marvelous growth of the mutual savings banks.

The book contains a general discussion of credit union theory and practice. It describes its historical background in the Raiffeisen and Schulze-Delitzsch systems of Germany and especially Desjardins' "Peoples Banks" of Quebec. Alphonse Desjardins established the first credit union in this country in Manchester, New Hampshire, in 1909, and Messrs. Pierre Jay as Bank Commissioner and Edward A. Filene of Boston sponsored a movement which resulted in the first general law permitting the organization of credit unions, being the Massachusetts act of 1909 which enacted recommendations contained in Mr. Jay's report of 1908.

Several other states have since passed laws to accomplish similar purposes, although there appears to be considerable variation in their provisions, and some of them are declared by our author to be quite worthless. Perhaps Mr. Bergengren appreciates the difficulty of framing a general law that would comprehend the intimate personal relations and the various methods of management which are being met by voluntary organizations in industrial, commercial, and banking institutions. He says that he realizes "that there are probably more credit unions operating in the United States without conforming with some specific credit union law than there are working in accordance" therewith. This statement is certainly true, and the situation will doubtless continue until the states deem it advisable to provide a closer control and supervision than is now found necessary in view of the high quality of management which is provided gratuitously.

Space will not permit of a detailed discussion of the debatable questions which are raised by this book. The author appreciates that there is no magic in the word "co-operation" and that it will not reduce the amount of skill required for success in the business to which it may be applied. But he seems to depart from that view when he discusses banking problems. For instance, he regards the credit union as superior to the pay-roll savings plan, such as that being promoted by the Savings Bank Division of the American Bankers Association, for the reason that the credit union "is managed by the members, exclusively for the members." Elsewhere he speaks with approval of the use of credit union funds and credit for co-operative merchandising, especially in agricultural districts.

This book emphasizes the need for an exhaustive and scientific study of the limitations as well as the possibilities of co-operative credit institutions and the extent to which they should be permitted to serve as savings depositories for others than borrowers. There is an obvious need for investing as well as for borrowing members in any organization for the benefit of borrowers. The same public policy which has placed restrictions which are often severe upon banks, and especially upon savings banks, may be invoked to protect investors (often erroneously called depositors) in co-operative credit institutions which do not make known the limitations upon repayment or even the chances of loss which are involved in their operation.

LIGHT AND COLOR IN ADVERTISING AND MERCHANDIZING. *By M. Luckiesh. 268 pp. D. Van Nostrand Company.*

MANUFACTURERS of fabrics or lamps, pianos, automobiles, or any of a thousand other nationally distributed articles should have this book, if only to remind them continually of two of their most productive salesmen—light and color.

Mr. Luckiesh, who is director of the applied science laboratory of the General Electric Company's National Lamp works, is an acknowledged authority in this field. In addition to the present volume he has to his credit a number of well-known works, including "Color and Its Application," "The Lighting Art," and "The Language of Color."

The possibilities of light and color as sales media have, as the author states, been greatly extended in recent years by new developments in printing and in lighting. Mr. Luckiesh attempts, with notable success, to analyze these potentialities, basing his discussion on years of observation and research. A study of the material he presents will be of value to all who are responsible in any way for the expenditure of the millions, if not billions, of dollars now being devoted to advertising manufactured products. The treatment is not too technical, with the result that the book makes a wide appeal. Advertising specialists will, of course, find it particularly enlightening, but it will be valued also by general readers, commercial artists, color printers, interior decorators, lighting specialists, architects, and the manufacturers already referred to in the first paragraph of this review.

After an introductory chapter, which presents the terminology of light and color, the author takes up the characteristics of color, color preference, and the emotional value of the various colors of the spectrum. In connection with the latter topic Mr. Luckiesh presents an interesting report, giving replies from 63 college students indicating three general influences of color—"exciting," "tranquilizing," and "subduing." Deep orange was voted the most "exciting," 59 of the 63 students so registering their reactions. Yellow-green led under the heading of "tranquilizing," receiving 39 votes, and violet heads the "subduing" column with 54 out of a possible 63.

No review of this book would be complete and discriminating without reference to the remarkable color work produced in the illustration of the volume. There are 3 colored plates in addition to the fine Maxfield Parrish frontispiece. Many of these are produced on special papers, which are plainly indicated so that a manufacturer or other advertiser may, if he wishes, secure similar stock for his own purposes. Altogether it seems clear that this is a book no advertiser can afford to overlook.

A METHOD OF COSTING PARTIALLY COMPLETED ORDERS. *By C. B. Williams. 10 pp. National Association of Cost Accountants.*

THIS publication of the National Association of Cost Accountants describes an actual installation which resulted in a considerable saving of clerical effort and at the same time gave more satisfactory cost results.

In stating the problem the author says:

> Something which causes a large amount of clerical work and a great deal of dissatisfaction is the attempt to obtain costs at the close of a month on items which are run more or less continuously, and which are in every possible stage of completion at every monthly closing. In such cases there is seldom a completed order of a definite stopping place at which cost can be figured. Two methods are probably in most common use to meet such conditions. One method is to use a cost-of-sales figure based on previous costs and then to absorb the difference between this figure and the actual cost, when obtained, in the cost of sales of subsequent months. The other method is to obtain the actual cost of the quantity completed and carry forward as work in process the cost of the uncompleted articles. The second method should give the more satisfactory results, but, as the reader well knows, it involves a considerable amount of clerical labor.

The methods described have been adopted by a concern manufacturing iron and aluminum cooking utensils. The cost procedure in the aluminum, machining, and polishing departments are clearly explained, together with the cost methods followed in making monthly closings.

The general content of the publication may be gained from the following summary:

> Issue production orders showing maximum quantities only. At the end of the month enter on these orders as the quantity to be produced the same quantity that was processed through the first operation.
>
> Complete these orders in the cost department as of the month in which they were started, but, for accounting purposes and bookkeeping convenience, recognize the calendar months.
>
> An order is named according to the month in which it is started. For instance, an order started in November is a November order and is treated as such until it is completed, although that is the sixth of December.
>
> The December labor and expense carried into November records is offset by accrual accounts which clear themselves in the month of December.
>
> If you think this cannot be done in your plant, you will be just like the ordinary human being who believes that what has not been done cannot be done. Of course, there are concerns where this method could not be used, but the opinion is ventured that few have more complicated problems than the manufacture of between eight hundred and a thousand articles, the production of which had been allowed to drag for periods of from two to twelve months.
>
> In this case the cost department rendered a very distinct service to the manufacturing department, in addition to lightening its own work.

MANAGEMENT AND ADMINISTRATION
CUMULATIVE INDEX, VOL. VI

The relative index which follows [illegible] is based upon the so-called "Brussels" classification. It is prepared especially for MANAGEMENT AND ADMINISTRATION by the United Engineering Societies Library (29 West 39th Street, New York), and is a part of the general plan used by them for classifying and indexing the literature of that great library. A description of the system and the manner in which it is employed in MANAGEMENT AND ADMINISTRATION will be found in the July 1923, issue, Pg. 79.

AUTHOR OR SUBJECT ENTRY — INDEX SYMBOL — VOL.: PG.

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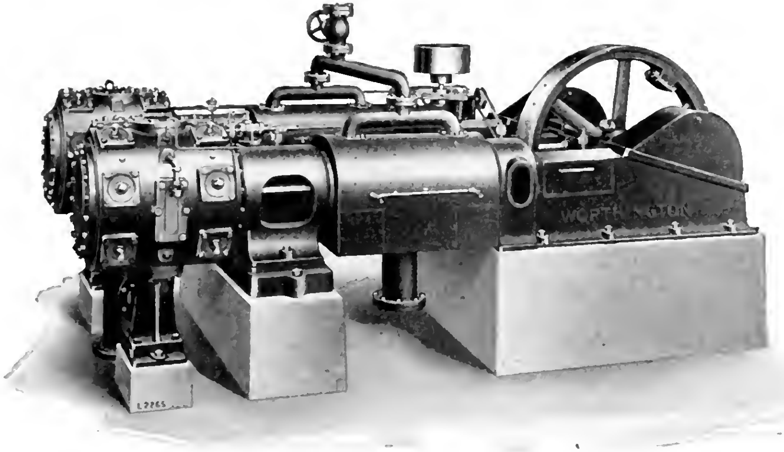

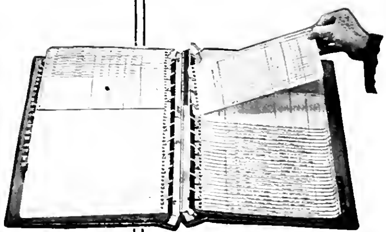

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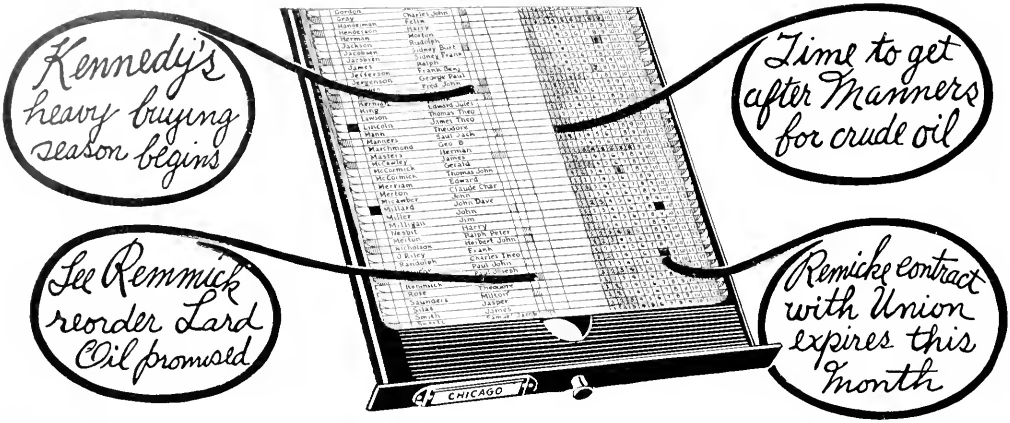
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Time to get after Manners for crude oil
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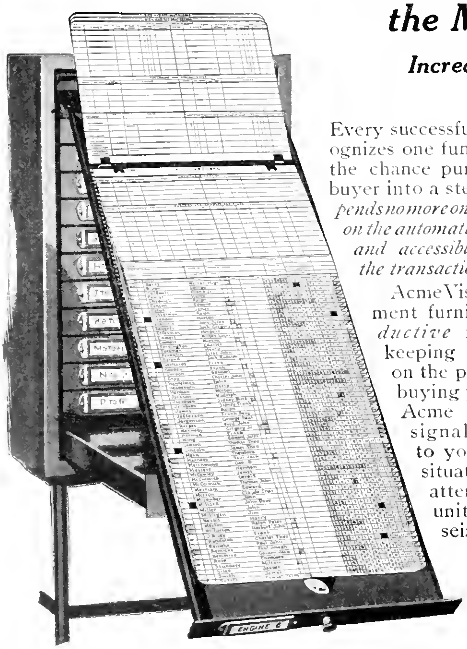
Remicke contract with Union expires this month
CHICAGO



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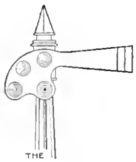
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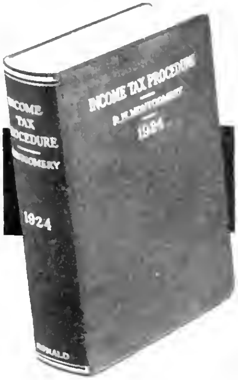

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